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The Structure of Prices in the neo-Sumerian Economy (II); The Wool:Silver Price Ratio

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Introduction[1]

The incidence in the Ur III economy of a price mechanism, calibrated from a bi-monetary barley:silver ratio of 1 gur (300 sila$_3$) of barley equal to 1 shekel of silver, was the subject of my earlier essay (Cripps 2017). The bureaucratic assertion of this bi-monetary price ratio in a commodity money economy has been regarded as an essential first step pursued by the state through its provincial institutions in administering prices (Hudson 2004: 117) and as a fundamental determinant of relative values in a command economy (Englund 2012:427, 441-5). Though often disputed for lack of documentary evidence of its promulgation by the state, an obligatory standard may be conditionally inferred from median and mode values of a distribution of these ratios albeit from a limited set of observations in a limited number of cuneiform texts dated to the middle of the neo-Sumerian period. The contrary view that prices were wholly or partly determined in the Ur III economy by market forces is also introduced in my earlier publication. It is not necessary to repeat that introductory review here, but it is useful to provide a context for the current analysis with a summary of the main findings from its forerunner.

Just as the whole of the Ur III corpus of administrative texts is highly skewed, originating mainly from two core provinces, Umma and Girsu, so are the observations of the barley:silver ratio. However, whereas Umma is the home of about 5% more of the Ur III cuneiform corpus than Girsu (Molina 2008: 52-3), occurrences of a 300 sila$_3$ to 1 shekel barley:silver ratio are highly skewed to administrative texts of the Girsu institutions. The greater number by far of examples of a ratio of this value are evident in those Girsu accounts which recorded either deliveries of barley quotas to the province's institutions by sharecroppers and the like, or which represented institutional expenditures of barley and, then, only in those relatively few instances where silver was paid in lieu of barley. These categories of accounts containing a barley:silver ratio, computed from the formula *n* gin$_2$ ku$_3$(-babbar) / še-bi *n* gur, are, in fact, almost exclusive to the Girsu corpus.

The Umma corpus has very few comparable records. The Umma texts which allow the computation of a barley:silver ratio predominantly fall into three categories, the "merchant" or "silver" accounts, loan documents and receipts. The merchant accounts are periodic summaries of the trading by the governing institutions via trade agents of surplus staple production for commodities required by them but not produced in their own manufacturing and agricultural activities. An important such staple was of course barley, but only fifteen, about half of the recovered Umma merchant accounts, contain information on the ratio of barley to

silver. The distinguishing feature of the merchant accounts, aside from a subscript of nig$_2$-ka$_9$-ak PN (dam-gar$_3$), is that all items are valued in silver and the accounts are totalled and balanced in silver rather than barley, so that in contrast to the Girsu categories referred to above the barley:silver ratio is computed via the formula n še gur / ku$_3$-bi n gin$_2$. Only three of the Umma merchant accounts witness a ratio of 300 sila$_3$ of barley to 1 shekel of silver. The other twelve have ratios which vary between 225:1 and 420:1. The sole Girsu merchant account which enables a similar computation, however, does attest to this value of 300:1 for the barley:silver ratio.

With the exception of two texts, Umma shares with Nippur the provenances of approximately two dozen silver loan documents from which a barley:silver ratio is potentially calculable. Significantly, but maybe erroneously, attempts have been made to use these documents to estimate a price of barley from the supposed barley equivalence present in the formulation n gin$_2$ ku$_3$-babbar / še-bi n gur, and the like, with which they are formulated (Snell 1982: 138-42). However, these documents clearly describe loans of silver to be repaid (su-su-dam or ag$_2$-e-dam) with barley, usually at harvest time. The amount of barley to be repaid per shekel of silver loaned varies between 400 and 600 sila$_3$ and is likely to include an interest payment (Gomi 1984:233) or a penalty payment especially if it apparently amounts to a *duplum* of the silver loan (Garfinkle 2004:4). The required assumption in this interpretation of these loan documents, is that the capital of the loan corresponds to 300 sila$_3$ per shekel. However, there is no direct evidence for this.

A similar picture is presented by those Nippur receipts from which a barley:silver ratio can be computed. These documents are formulated like a silver loan without a repayment clause. The quantities of barley per shekel, nevertheless vary over the same range of values as those in the silver loans which suggests they may be somehow related, though it remains unsafe to assume so. Nor is it particularly evident whether the Nippur documents are institutional or non-institutional records. There is, however, a difference between the Umma silver loan documents and the Umma receipts. The Umma silver loan documents exhibit similar formulations and an equally variable range of barley:silver ratios to those from Nippur, even though more of them could be institutional records. A greater proportion of the Umma receipts are clearly documents produced by the institutions and often register payments of silver in lieu of barley to senior officials (invariably members of the governor's family). The majority of these revenues of the institutions have a barley:silver price ratio of or near 300:1.

In summary, evidence of a barley:silver price ratio of 300 sila$_3$ to 1 shekel, is predominantly from those institutional accounts of Girsu which monitor incoming flows of barley from dependent and other producers to facilities of the governing households such as granaries, threshing floors and milling establishments and outgoing flows of barley in institutional expenditures for various purposes; in one instance in exchange for a large quantity of silver. These accounts mainly relate to the internal production and distribution processes which are part of the provincial administration's agrarian management. It is reasonable to suppose that where the principal requirement was for the delivery of their share of crops to the administration, a fixed rate to convert silver to barley would be required in those relatively few instances where silver was substituted for barley owed by producers.

A single text from Umma exemplifies this category of text and this, too, attests to a barley:silver ratio of 300 sila$_3$ to 1 shekel and may suggest that a policy of setting a ratio of 300:1 was standardized throughout the Ur III state at least in internal processes of the governing administration, but this is limited evidence from which to make such an assumption. Many of the Umma texts describe interactions of the provincial governments with an external trading environment and depict much greater variability in these ratios even though they arise from the provision of barley by the administration to merchants to trade on their behalf. Apart from a few

receipts, other Umma texts such as the silver loans documents cannot be said to provide a measure of the silver price of barley.

The necessity to exclude both receipts and loan documents from Nippur limits the evidence to texts of quite different sub-genres of cuneiform texts and which are nearly mutually exclusive to two different Ur III provinces. Understanding of the institutional administration of these provinces is clouded by scholarly uncertainty about the congruence of their organisations. The respective systems of governance of Girsu and Umma are usually considered to have marked differences (Steinkeller 2003:41-2, Sharlach 2004:63, de Maaijer 1998:53-4) but perhaps gaining greater acceptance is the perception of the Ur III state as a supra-structure on existing provincial and particularly temple organisations (Sallaberger 2014:105). Furthermore, despite the skewness in the observations of the barley:silver price ratios, there is ample evidence in the categories of texts from Girsu that the accounting system there paralleled that reconstructed for the Umma institutional economy (Steinkeller 2003). Standardisation of provincial accounting systems following Šulgi's reforms increases the likelihood of a standard barley:silver price promulgated by the State, even if as already noted there is limited evidence from Umma.[2]

As Hudson inferred the state imposition of a barley:silver price or equivalency implies a benchmark against which the relative values or prices of other commodities were measured and may have been controlled. Despite his concern with price variations introduced to silver value equivalencies in the merchant accounts, Englund identifies relative values of a shekel of silver as 300 litres of barley or 30 litres of fish oil or 10 litres of clarified butter or a healthy sheep, while Sallaberger (2014: 97) suggests a "standard price relation" of 1 shekel of silver equals 10 minas of wool. It is not certain, however, that Sallaberger implies "standard" to mean any more than Snell's (1982: 178-180) median price for wool, however determined.

If in the Ur III economy other commodity prices were standardised against an imposed 300 litres of barley per shekel of silver, we would expect such a relationship to be most perceptible in the prices of major staple commodities emanating from institutional production processes. Second to barley, the foremost staple was wool, which not only provided rations remunerating temple and other labour forces and raw materials with which to manufacture finished products, but also surpluses with which to trade. This contribution therefore explores the wool (siki):silver price ratio within the contexts of the roles played by wool in the Ur III economy and estimates its relative value in relation to the barley:silver ratio.

On sheep and wool
Produced by the Sumerian economies since the earliest times, wool was essential to the provisioning with rations of dependent workers and others in the institutions of the (city-)state and in addition supplied a product to be traded in exchange for foreign goods. These two attributes of wool, the first of which signposts

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[2] Steinkeller (1991:16-17) locates Šulgi's administrative reforms to the second half of his reign, after Š 21 (Year in which, after Ninurta, the ensi$_2$-gal of Enlil, had pronounced an ominous decision in the temple of Enlil and Ninlil, Šulgi, the king of Ur, put in order the *field* accounts in the temples of Enlil and Ninlil). He proposes that among these reforms were the creation of a unified administrative system for the whole of Babylonia. This encompassed the introduction of the bala taxation system; the creation of a state bureaucratic apparatus and scribal schools with standardised training; the reform of the writing system; the introduction of new accounting and recording procedures and new types of archival records; the reorganisation of the system of weights and measures; the introduction of the "Reichskalender" which became official throughout the Ur III state, all of which created an apparatus which may have enabled the "administration" of prices. Note however, Selz (2010:12-13) who queries attribution of the innovation of these reforms to Šulgi and suggests that several them have historical forerunners. See also Cripps (2014:213-215) for examples of third millennium precursors of the "balanced" account.

its intrinsic utility, are attested in texts from as early as the Uruk and Jemdet Nasr periods (Charvát 2014: 81, 82).

While both raw wool and wool processed into cloth and clothing were allocated as rations (respectively siki-ba and tug$_2$-ba) to dependents, in the Ur III period only the raw product appears to have been supplied to the merchants to trade for other goods (Sallaberger 2014:98). This study therefore focusses on the relative prices of wool and excludes consideration of such prices of garments and textiles manufactured from it.

In the Ur III state, wool was produced from the large flocks of sheep managed by the provincial temples for the ensi$_2$, as witnessed by a text, YOS 04, 237, from Umma dated ŠS 7(Stępień 1996:50, Sallaberger 2014: 105). The text records the transfer of the flocks supervised by the several temples of Umma from one ensi$_2$ into the ownership of his brother who succeeded him as governor in the second month of that year. "*n* various sheep and goats, the sheep inspected, Dadaga the governor received from Ayakala the governor" (*n* udu maš$_2$ hi-a, udu si-il$_8$-la/ki a-a-kal-a ensi$_2$-ta/da-da-ga ensi$_2$-ke$_4$ i$_3$-dab$_5$).[3]

In both Lagaš and Umma two main types of sheep were herded. udu eme-gi "native or Sumerian sheep" were common to both provinces whereas udu gukkal "fat-tailed sheep", from which a high-quality wool was produced, were mainly husbanded in Lagaš. udu kur-ra "mountain (or foreign?) sheep", on the other hand, were kept around Umma where they were *exceptionally* referred to as gukkal (Sallaberger 2014: 104). If so, the Umma gukkal may have been a different breed of sheep from the Lagaš udu gukkal, since the wool from the udu kur-ra was inferior in quality to that from the udu gukkal of Lagaš (Potts 1997: 92). Alternatively, Stępień (1996:21) has hypothesised that at Umma the term udu kur-ra was a general term designating all types of non-Sumerian sheep "*among which* was udu gukkal". At Lagaš on the other hand, udu gukkal was the general term for all foreign sheep, most of which were the gukkal breed. udu ge$_6$ "black sheep" are widely attested in Umma but less frequently in, though not absent from the Girsu texts, and purportedly produced the least valuable wool. White wool was probably more highly valued as it was commonly not dyed in the Ur III period and sheep flocks were controlled to breed the minimum number of black sheep.[4] Of the white sheep the udu kur-ra provided more and better wool than the udu eme-gi and siki (eme-)gi "Sumerian wool" was worth less than siki kur-ra "mountain wool" and, therefore, than wool from the udu gukkal. The GI wool was coarse and of low quality, only rarely entering the system of five classes with which wool was graded in the Ur III economy (Potts *ibid*).[5]

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[3] Throughout the Umma texts in which this Ayakala is attested, both before and after he became ensi$_2$, his name is spelled either a-a-kal-a or a-kal-a. In this essay, I translate both spellings as Ayakala.

[4] So Sallaberger (*ibid*.). There is, however, only one occurrence of a siki ge$_6$:silver ratio in the CDLI database, in the Umma text SANTAG 6, 381, and this is equal to 10 ma-na siki ge$_6$ per shekel of silver, which is the median and mean price ratio for siki GI, which Sallaberger considers to be the "standard" price of wool. The existence of only one example, however, precludes any comparable analysis with the price of white wools.

[5] I have largely combined Sallaberger's (2014) and Potts' (1997) reviews of sheep and wool types. Categorization is supported by the wool types which were extracted from a search of the CDLI transliterations via the term "siki, ku$_3$-bi". This search produced silver equivalencies for siki, siki GI, siki kur-ra, and siki ge$_6$. There was in fact only one example of siki ge$_6$ "black wool" with which a silver equivalent was associated. This example was excluded from the analysis therefore. Sallaberger argues that in Umma the udu kur-ra and udu gukkal are the same animal, the "fat-tailed" or "mountain sheep", although an Ur III Sumerian reading of gukkal remains unknown, while there is no etymological support for the word as kungal (Sallaberger 2104: 104 fn. 46). He also proposes (fn. 45) that there is probable lexical support for reading uli as eme-gi = *Šumerum*. Other scholars recognised five classes of wool, ranging from royal to normal/medium (or "poor" in Pomponio 2010:261), as well as coarse unclassified wool. The Ur III sheep types were by and large considered to be three in number udu gukkal, udu kur-ra and udu uli/eme-gi. The udu gukkal "fat-tailed" sheep produced wool of first and second quality, the udu kur-ra yielded fourth and fifth class wool and the udu eme-gi, the most common sheep, produced GI wool which was coarse, more often unclassified, and used for wool rations and the manufacture of

Wool:silver price ratios
siki (GI) and siki kur-ra

Whereas the Ur III mensuration of barley is by volume using the gur system, wool, like silver, is measured by weight in the mina system. The siki (GI):silver ratios in this analysis are computed primarily from occurrences in the Ur III texts of *n* ma-na siki (GI) / ku$_3$-bi *n* gin$_2$ and *n* gin$_2$ ku$_3$(-babbar) / siki-bi *n* ma-na. The many

Figure 1. Distribution of siki (GI):silver ratio
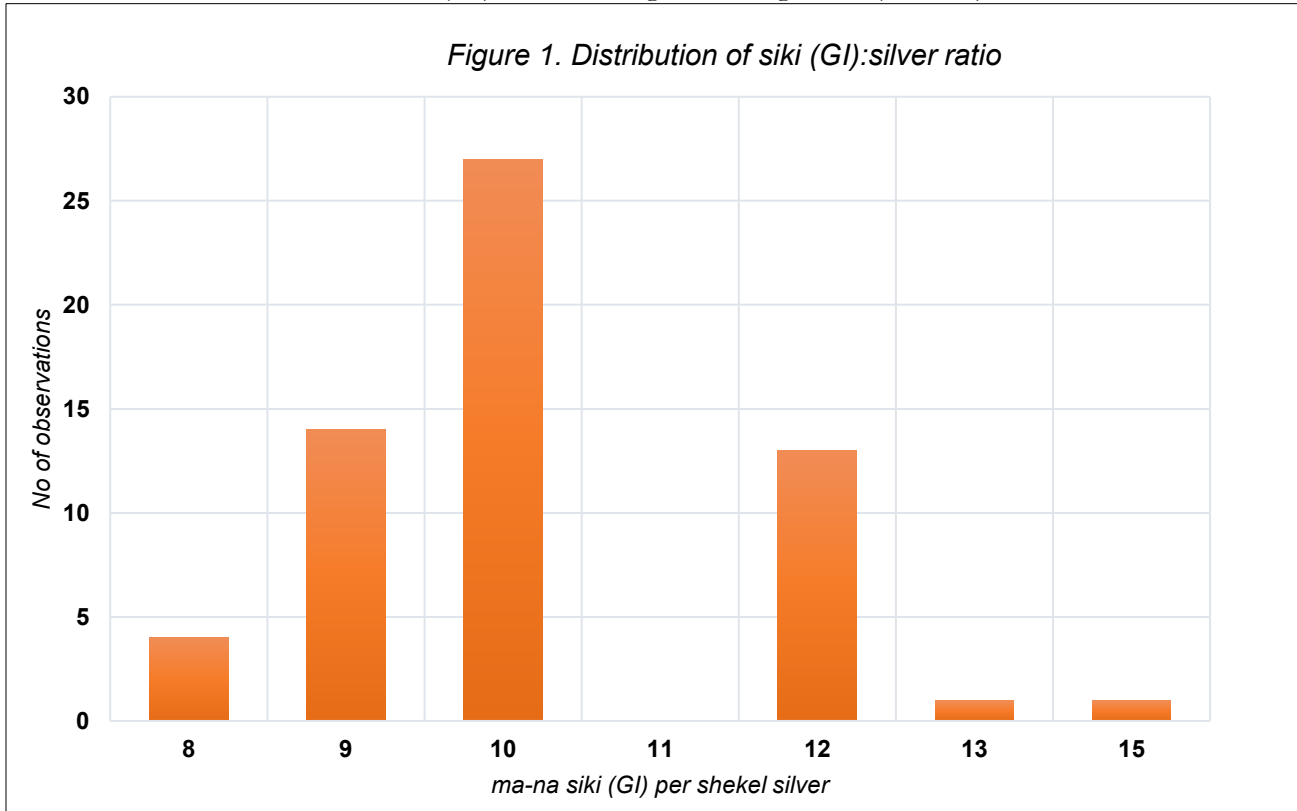
fewer siki kur-ra:silver ratios, however, only occur in one version of these formulations, *n* ma-na siki kur-ra / ku$_3$-bi *n* gin$_2$.[6] All were extracted from the transliterated texts in the CDLI database via searches for "siki, ku$_3$-bi" or "ku$_3$(-babbar), siki-bi". The Appendix lists 61 observations of the siki (GI):silver ratio in Year Date order. All but four of these are to be found in texts with an Umma provenance. There are 27 additions to Snell's tables (Snell 1982:179-181).

Figure 1 is a histogram of the distribution of the wool (siki (GI)):silver values. The measures of central tendency, the mean, median and mode of the distribution, given at the end of the Appendix list, are all equal to 10 minas of siki (GI) per shekel. Figure 1 shows that while there is a substantial peak at the mean of 10

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coarse garments (Potts 1997:92). Following Sallaberger, siki GI may be read as siki (eme)-gi, and it is just as likely that the siki sign when unqualified does not mean anything other than wool from the "native sheep", just as the one word "sheep" (udu) was widely used to indicate a general term "native sheep" (udu eme-GI) (Stępień 1996: 19). On the other hand, Snell's table of prices distinguishes siki from siki GI and has a further category of "Other Kinds of Wool" (Snell 1982: 179-181), distinctions which, however, do not discriminate the wool:silver ratios or "prices" of his categories.

[6] The notation *n* ma-na of wool is used here as a generalisation for the whole of the mina system and includes all weights gu$_2$ (talent = 60 ma-na), ma-na (ma-na = 60 shekels), gin$_2$ (shekel = 180 barleycorns) and še (barleycorn) and equally the notation "gin$_2$ of silver" also summarises the whole range in the mina system.

minas per shekel, a similar proportion of the distribution is almost equally divided between the values of 9 and 12 minas per shekel in an asymmetrical distribution. Despite the equality of all the measures of central tendency, typical of a normal distribution, the distribution of the sample values appears to be somewhat skewed to the right. The standard deviation around the mean ratio is ±1.4 ma-na per shekel and 68% of the distribution falls within an area defined by the mean of 10:1 and one standard deviation below it. The values of 12:1 and greater, about a quarter of the distribution, are more than one standard deviation above the mean. It can be seen from Figure 4 that these higher values of the ratio occur only after the Ur III year date AS 8. This is discussed further below. Notwithstanding the relative asymmetry of the distribution, the mean of 10 minas siki (GI) per shekel may be assumed to be representative of the wool:silver price ratio, at least that is, in the Umma economy. On this basis, it is perhaps possible to regard 10 minas per shekel as the "standard" silver price of wool, although it is clear from Figure 1 that there is considerable dispersion around this mean value.

Table 1 below lists the thirteen texts which contain the fourteen observations of the siki kur-ra:silver ratio present in the Ur III texts of the CDLI records. Each of the thirteen texts has an Umma provenance. Effectively, therefore, the whole of the available sample of wool:silver ratios or "prices" of wool of whatever quality is from Umma records. The geographic bias in the surviving wool price observations is even more marked than in my earlier sample of the barley:silver price ratio (Cripps 2017)[7].

Except for the prices given in four of the 14 instances extracted in table 1, the siki kur-ra:silver ratio is substantially smaller than the siki (GI) ratio. A smaller quantity of wool per shekel represents a higher relative price or value. The mean price ratio in the siki kur-ra sample is 8.5 minas of wool per shekel of silver compared with a sample average for siki (GI) of 10 minas per shekel of silver, the median and the mode ratios are both 8:1. Figure 2 compares the price ratios of siki kur-ra with the mean of the siki (GI):silver ratios or so called "standard" price of wool.

Table 1. Receipts and deliveries of siki kur-ra with silver equivalent values.					
Text sigla	Subscript	Indicative Phrases	Provenance	mean ma-na siki kur-ra per shekel silver	Year Date
AUCT 1, 562	Date	*n* ma-na siki kur-ra, ku$_3$-bi *n* gin$_2$, PN	Umma	8	Š 45
AUCT 3, 313	Date. Seal of PN1	*n* ma-na siki kur-ra, ku$_3$-bi *n* gin$_2$, ki PN*-ta, PN1 šu ba-ti	Umma	10	ŠS 1
AUCT 3, 251	Date. Seal of PN1	*n* ma-na siki kur-ra, ku$_3$-bi *n* gin$_2$, ki PN*-ta, PN1 šu ba-ti	Umma	10	ŠS 1
AUCT 3, 350	Date. Seal of PN1	*n* ma-na siki kur-ra, ku$_3$-bi *n* gin$_2$, ki PN*-ta, PN1 šu ba-ti	Umma	8	ŠS 2
MVN 15, 171	Date. Seal of PN*	*n* ma-na siki kur-ra, ku$_3$-bi *n* gin$_2$, PN1, e$_2$-kišib$_3$-	Umma	6	ŠS 2

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[7] This, even though in the CDLI database there are nearly 2000 Ur III texts with over 5500 entries relating to the use and role of wool. The provenances of these various attestations are from Adab, Garšana, Girsu, Irisagrig, Isin, Nippur, Puzriš-Dagan, Umma and Ur.

| Table 1. Receipts and deliveries of siki kur-ra with silver equivalent values.					
Text sigla	Subscript	Indicative Phrases	Provenance	mean ma-na siki kur-ra per shekel silver	Year Date
		ba GN la$_2$-a-ta, kišib$_3$ PN*			
Nebraska 53[8]	Date	n ma-na siki kur-ra, ku$_3$-bi n gin$_2$, PN, siki gibil$_4$, kišib$_3$ nu-ra-a	Umma	8	ŠS 2
Princeton 1, 300	Date. Seal of PN1	n ma-na siki kur-ra, ku$_3$-bi n gin$_2$, ki PN*-ta, PN1, PN2 šu ba-an-ti	Umma	8.5	ŠS 2
AUCT 1, 444	Date	n ma-na siki kur-ra gibil, ku$_3$-bi n gin$_2$, PN dam-gar$_3$, mu-ku$_x$(DU), e$_2$-kišib$_3$-ba GN u$_3$ e$_2$-kišib$_3$-ba TN-ta	Umma	8	ŠS 2
OrSP 06, 59 Wengler 45	Date	n ma-na siki kur-ra, ku$_3$-bi n gin$_2$, PN1, šu ba-an-ti, ku$_3$-bi nu-mu-ku$_x$(KWU147), kišib$_3$ nu-ra-a, PN*.	Umma	8	ŠS 2
RSO 83, 352 50	Date	n ma-na siki kur-ra, ku$_3$-bi n gin$_2$, ki PN*-ta, PN1 šu ba-ti	Umma	10	ŠS 2
AUCT 2, 392	Date	n ma-na siki kur-ra du, ku$_3$-bi n gin$_2$, ki PN*-ta, PN1 šu ba-ti	Umma	8.5	ŠS 3
AUCT 3, 373	Date. Seal PN2	n ma-na siki kur-ra gibil, ku$_3$-bi n gin$_2$, ki PN*-ta, PN1 šu ba-an-ti, kišib$_3$ PN2	Umma	10	ŠS 3
AAICAB 1/1, pl. 030, 1911-212	Date. Seal PN1	n ma-na siki kur-ra gibil, ku$_3$-bi n gin$_2$, ki PN*-ta, dam PN1 šu ba-ti, giri3 PN2	Umma	8	ŠS 3
PN* = ur$_4$-ša$_3$-ki-du$_{10}$			Mean	8.5	
			Median	8	
			Mode	8	
			Std. Dev	1.18	

The fourteen price ratios recorded in Figure 2 are from thirteen texts, which are the only transliterated texts from which prices of siki kur-ra can be estimated. Discounting the value of six minas per shekel as an outlier to the distribution, it is evident from Figure 2 that the siki kur-ra:silver ratio varies between 8:1 and 10: 1 compared with the mean of 10:1 for the siki (GI) distribution and has virtually twice the number of

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[8] There are two separate "mountain" wool:silver ratios in Nebraska 53 from transactions by two different PNs. Both ratios are equal to 8 ma-na siki kur-ra per shekel of silver. These are the only occurrences of siki kur-ra in Snell's table of wool prices, where prices are given in še per ma-na (22.5) rather than ma-na per shekel (8), (Snell 1982: 180). All other texts except one were published later than Snell's monograph. The exception was Deimel's 1923 publication of OrSP 06, 59 Wengler 45.

observations at 8:1 compared with those at 10:1. Twelve of the texts are dated to the first three years of Šu-Suen time as king. The exception is in an earlier text from the intercalary month of Šulgi 45. There is some indication that from AS 8 to IS 3 the average of the siki (GI):silver ratio was nearer 12:1 (see Figure 4 in which 13 of the 21 observations from that period have a value of 12:1) which suggests that at an average of 8 minas per shekel, the value of siki kur-ra may have been 33% greater than siki (GI).

It is not entirely clear that wool quality considerations explain this "price" difference. While siki kur-ra was used to produce textiles and garments of third, fourth and normal/medium (du) qualities, see the Umma text from AS 4, BPOA 6, 1309, so was siki, see PPAC 5, 1700 dated AS 7. BPOA 6, 1248 from AS 1 Umma distinguishes between siki kur-ra and siki, while suggesting that both are used in the production of third and fourth quality textiles. Many texts also distinguish siki GI from siki. The Šulgi 44 text UET 3, 1535 is particularly instructive, differentiating several different qualities of siki as šar₃ "royal", used for tug₂ us₂ šar₃ "royal quality cloth", siki 3-kam us₂ "third quality wool", siki 4-kam us₂ "fourth quality wool", siki du "normal quality wool", siki GI "Sumerian wool" and siki ge₆ "black wool". Substantial quantities of each of these wools, e₂-kišib₃-ba-ta, ugula uš-bar-ra-ke₄-ne, šu ba-ti "from the sealed store, the overseers of the weavers received". The wool is probably listed in order of the quality of the wool with black wool at the end of the list (Sallaberger 2014: 104). Confusingly, siki (eme)-gi, apparently, could also be šar₃ "royal" quality used for the best quality cloth - (PPAC 5, 1010 obv. 1). Perhaps a better indication that siki and siki GI might be considered equivalent is that their wool:silver price ratios were the same or at least covaried.

Figure 2. Umma minas siki kur-ra per shekel silver
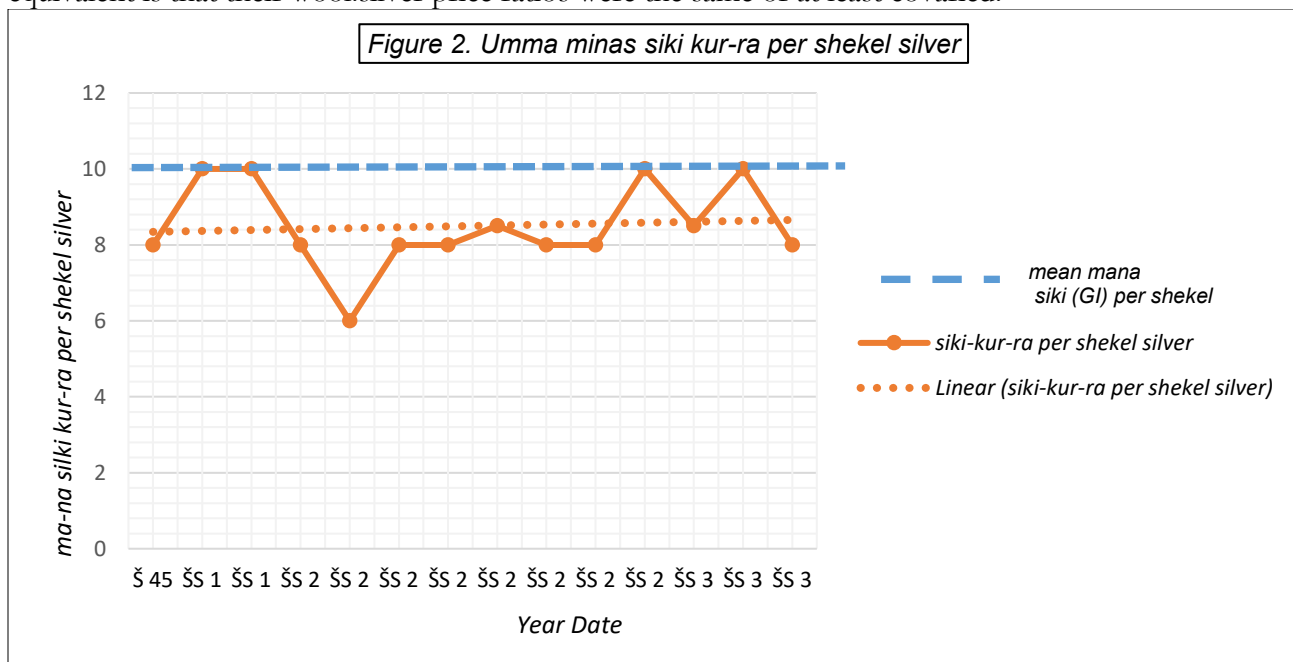
The few examples we have from the limited sample of the siki kur-ra:silver ratio possibly suggest that on average "mountain/foreign" wool as evidenced by the price ratio was valued more highly than siki (GI), though this is not fully verifiable and is indeed contradicted in the few texts in which both are "priced" or valued alongside each other. In two texts from ŠS 1, AUCT 3, 313 and AUCT 3, 251 both siki kur-ra and siki GI have a wool:silver equivalence of 10 minas per shekel. In AUCT 1, 444 dated SS 2, though the two types of wool appear side by side, the siki GI is qualified as sumun "old" and the siki kur-ra as gibil "new". The "old" GI wool has a price ratio of 12:1 and the "new" mountain wool a ratio of 8 minas per shekel. The distinction between "old" and "new" may refer to the fact that since wool was only plucked or combed from sheep once a year when moulting (Andersson Strand 2014:44, Breniquet 2014: 65), the "old" wool was either

plucked a year earlier or was from an older sheep than the "new" wool, which was from a sheep less than a year old and being lamb's wool was of higher value. On the other hand, there is an indication that the average price/value of wool (siki GI) may have fallen to 12 minas per shekel of silver at ŠS 2. Furthermore, the "old" GI wool may, perhaps not surprisingly, have come from a storage facility in a different geographic location to that of the "new" mountain wool. AUCT 1, 444 records that the old GI wool "was not delivered" (nu-mu-ku$_x$(DU)) whereas the new kur-ra wool "was delivered" (mu-kux(DU)) by a dam-gar$_3$, e$_2$-kišib$_3$-ba ki-tuš-e$_2$-la$_2$ u$_3$ e$_2$-kišib$_3$-ba pa-pah-ta from the stores of two temple establishments, "the sealed store of the e$_2$-la$_2$ dwelling? and the sealed store of a sanctuary". Both occurrences in Nebraska 53 record a mountain wool:silver "price ratio" of 8 minas siki kur-ra per shekel of silver and Nebraska 53 rev. 3 (siki gibil$_4$) testifies that the wool in each transaction is "new" wool. Nevertheless, several of the occurrences of siki kur-ra per shekel extracted into table 1 have a ratio of 8:1 are not qualified as "new" wool. Further contradictions are introduced by AUCT 3, 373 in which the siki kur-ra gibil:silver ratio is again 10:1 and AUCT 2, 392 in which the siki kur-ra du "mountain wool of normal quality":silver is 8 ½ :1.

The variations in the siki kur-ra:silver ratio evident from Figure 2 for the most part occur in a single context. First, the thirteen texts in which the observations of this ratio occur are all from Umma and second, twelve of these are dated to the first three years of Šu-Suen's reign. Third, in nine of the twelve texts, perhaps the same ur$_4$-ša$_3$-ki-du$_{10}$ who may be the scribe of an Umma administrative institution distributes "mountain wool" to, or exchanges it for silver with, various recipients. Eight of these nine texts are formulated as receipts of wool from ur$_4$-ša$_3$-ki-du$_{10}$, which except for OrSP 06, 59 Wengler 45, share a syntax of "*n* ma-na siki kur-ra" / ku$_3$-bi *n* gin$_2$ / ki ur$_4$-ša$_3$-ki-du$_{10}$-ta / PN1 šu ba-(an)-ti, whereas another, MVN 15, 171, records the weighing out of wool from a sealed storehouse in a document sealed by him, adducible only providing that we can associate the ur$_4$-ša$_3$-ki-du$_{10}$ of the receipts with ur$_4$-ša$_3$-ki-du$_{10}$, dub-sar, dumu ba-sa$_6$-ga.[9] OrSP 06, 59 Wengler 45 suggests that the siki kur-ra received from Uršakidu is actually *exchanged* for a quantity of silver. It may therefore be possible that here, ku$_3$-bi denotes the exchange "price" of the wool rather than an equivalent value for accounting purposes, since in OrSP 06, 59 Wengler 45, although the spouse of a šabra received the wool from him, Uršakidu did not receive the silver; ku$_3$-bi nu-mu-ku$_x$ "its silver was not delivered" and thus did not seal the document – kišib$_3$ nu-ra-a, ur$_4$-ša$_3$-ki-du$_{10}$.

A contextual analysis of siki (GI):silver price ratios
We have seen that the context and purpose of a text was highly significant in determining the variation in the barley:silver price ratio. The texts in which the siki GI relative prices arise may be assigned to the following categories.

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[9] MVN 15, 171 reads obv. / 8 ma-na siki kur-ra / ku$_3$-bi 1 ^{1}/$_3$ gin$_2$ / nin-e$_2$-gal-e / e$_2$-kišib$_3$-ba e$_2$ ki-ma-da-sal$_4$-la la$_2$-a-ta / rev. / kišib$_3$ ur$_4$-ša$_3$-ki-du$_{10}$ / seal impression / iti šu-numun / mu ma$_2$ ^{d}en-ki ba-ab-du$_8$. Seal: ur$_4$-ša$_3$-ki-du$_{10}$ / dub-sar / dumu ba-sa$_6$-ga. "8 minas of mountain wool, its silver 1 ^{1}/$_3$ shekels, (for) Ninegale, weighed out (from) the sealed store e$_2$ ki-ma-da-sal$_4$-la, sealed by Uršakidu, month 6, Šu-Suen 2. Seal: Uršakidu, scribe, son of Basag". This reading suggests, especially when taken together with receipts excerpted in table 1, that Uršakidu, a scribe, may have had some role in both the distribution from and delivery to an Umma institution of wool from the flocks of the province. Indeed, his responsibility may also have included at least a clerical duty in recording deliveries of animals to an institution. The CDLI transliteration of OrSP 06, 59 Wengler 46, for example, reads obv. / 1 sila$_4$ gaba / ur-e$_2$-maš, / mu-ku$_x$ šabra / kišib$_3$, ur$_4$-ša$_3$-ki-du$_{10}$ / iti ^{d}dumu-zi / mu us$_2$-sa ^{d}šu-^{d}suen lugal. Seal: ur$_4$-ša$_3$-ki-du$_{10}$ / dub-sar / dumu ba-sa$_6$-ga? "1 weaned lamb, (from) Uremash, delivery (to) the major-domo, received under the seal of Uršakidu, month 12. ŠS 2. Seal: Uršakidu, scribe, son of Basag". In AUCT 3, 393, a document from a month later in ŠS 2 and again sealed by Uršakidu, the scribe son of Basag, a weaned goat and a ram are deliveries to another official (maškim).

The ur$_4$-ša$_3$-ki-du$_{10}$ of the siki kur-ra receipts may have also officiated in the distribution of a wider range of staple commodities than wool in the years AS 7-ŠS 3. In ŠS 2 alone Umma receipts recording transfers of commodities other than wool from ur$_4$-ša$_3$-ki-du$_{10}$ comprise barley (AUCT 1, 306), AUCT 1, 968, AUCT 3, 331), dates (AUCT 1, 963, AUCT 3, 378), aromatics (AUCT 3, 375) and silver (OrAnt 22, 203 HSM 1911.05.023).

1. *Accounts of wool revenues and expenditures of institutional households.*
   (i)   Collected summaries (*Sammelurkunden*) of wool income and expenditure which contain payments of silver in lieu of wool.
   (ii) Primary records of payments of silver in lieu of wool.

2. *Payments and receipts of wool with silver equivalents*
   (i)   Primary receipts and payments.
   (ii) Miscellaneous deliveries and expenditures of wool to and from institutional households.

3. *Wool trades by institutional households via merchants*
   (i)   Expenditure and receipt of wool with silver equivalents in merchant accounts.

Texts analysed in each of these categories are excerpted in tables 2-6 below and the account type defined by each of the tables into which an occurrence of the siki (GI):silver price ratio is assigned is incorporated in its list entry in the Appendix. These are augmented with table 7, which excerpts texts incorporating a siki (GI):barley ratio, the correlation of which with the siki (GI):silver ratio is discussed later.

A glossary of the Sumerian words and phrases indicative of these account types is included here to promote a fuller understanding of the tables.

Glossary of Sumerian terms used in tables

Sumerian	*English Translation*
ag_2-e-de_3	to be measured out
$arad_2$	servant/slave
dam-gar_3	merchant/trade agent
diri(g)	surplus
dub-sar	scribe
e_2-gal	palace
e_2-gal-$še_3$ gen-na	was sent to the palace
e_2-$kišib_3$-ba	sealed storehouse
$ensi_2$	governor
gibil	new
gin_2	shekel
$giri_3$	via/conveyed by
$giri_3$-se_3-ga	attendants of palace and temple
gu_2	talent = 60 minas
gu-za-la_2	throne bearer
ka-$guru_7$	granary supervisor
ki PN	for PN
ki PN-ta	from PN
$kišib_3$ nu-ra-a	seal not rolled
$kišib_3$ PN	received by/under the seal of *Person Name*
$kišib_3$ še e_2-ta šu [su]-ba	sealed document of barley collected from the temple (^{d}Šara$_2$)
ku_3(-babbar)	silver
kurušda	animal fattener
la_2-ia_3	arrears/deficit
la_2-ia_3(-ta) su-ga	replaced arrears/deficit
ma-na	*mina* = 60 shekels
maš a-$ša_3$-ga	irrigation tax of a field
mu lugal-bi in-pa_3	he swore (an oath) in the name of this king
mu-ku_x(DU)	delivery

na-gada	shepherd
nig_2-ka_9-ak PN dam-gar_3	(balanced) account concerning PN the merchant
nig_2-ka_9-ak dam-gar_3-ne, lu_2-kal-la	(balanced) account of the merchants (overseen by) Lu-kala
nig_2-ka_9-ak nig_2-sa_{10}-ma	(balanced) account of purchases
nig_2-ka_9-ak si-i_3-tum	(balanced) account of remaining deficit
nig_2-ka_9-ak siki	(balanced) wool account
nig_2-ka_9-ak uruda sa_{10}-a	(balanced) account of purchased copper
nu-$banda_3$	supervisor
nu-$banda_3$-gu_4	overseer of plough oxen/cultivation manager
sa_{10}	price/purchase
$ša_{13}$-dub-ba	archivist/chief accountant
$ša_3$-bi-ta	therefrom
sag-nig_2-gur_{11}-ra-kam	debits, capital, available assets
sanga	chief temple administrator
še su-ga sipa-da	replaced barley of the shepherds
še-bi	its barley
siki (GI) = siki eme-gi	wool from native sheep
siki hi-a	mixed wools
siki kur-ra	wool from mountain/foreign sheep
siki-ba	wool ration
siki-bi	its wool
$sila_3$	≈ 1 litre
$sila_3$ $geš_2$-da-ta	each sixty litres
sipa	shepherd
sipa-de_3-ne	the shepherds
šu ba-ti	he received
sumun	old
šu-$nigin_2$	total
$šuš_3$	chief administrator of livestock (*here* sheep)
su-su-dam	it is to be replaced
ugu_2…ba-a-gar	was debited to the account
ugula	overseer
uruda	copper
zi-ga bala-a	expenditure of the bala
zi-ga-am_3	disbursed/expended or booked out in an account"

Accounts of wool revenues and expenditures of institutional households
nig_2-ka_9-ak (siki) with silver paid in lieu of siki (GI)

Each of the four texts in Table 2 is a balanced account from an Umma institution with a framing syntax of (si-i_3-tum), šu-$nigin_2$ *n* gu_2 siki, (sag-nig_2-gur_{11}-ra-kam), $ša_3$-bi-ta… šu-$nigin_2$ *n* gu_2 siki, zi-ga(-am_3), la_2-ia_3/diri and within which is an occurrence of a payment of silver in lieu of wool as indicated by the phrase *n* gin_2 ku_3(-babbar) / siki-bi *n* gu_2. The accounts are balanced in wool not silver. Three of the texts have a subscript denoting a "balanced wool account" (nig_2-ka_9-ak siki).

The first of these, [AAICAB 1/1, pl. 065-066, 1924-0666](#), is a balanced wool account of the $ensi_2$ of Umma and is dated to AS 3. The debits or sag-nig_2-gur_{11}-ra-kam of the account comprise the remaining wool balance from the previous year, AS 2, to which are added deliveries of various wools from plucked sheep, deficits of still unshorn as well as plucked wool, wool provided by Ur-e'e a chief livestock administrator of the Umma temples (Stępień 1996:51) and several shepherds, and wool for streamers for cultic emblems from a $gudu_4$ priest. From these are expended (zi-ga-am_3) wool for cultic purposes, offerings to a series of named gods (sa_2-du_{11} dingir-re-ne) and for standards (šu-nir gu_2-de-na), rations for workers, for attendants ($giri_3$-se_3-ga) of the palace and temples, for potters ($bahar_3$ ma-da) and for a priestess (lukur) of the temple of Šara. Quantities of wool are also dispensed for cloth, to weavers and to merchants. All allocations are of wool except two, which

comprise large amounts of silver paid to the provincial government to replace the arrears of wool owed by shepherds (la$_2$-ia$_2$ su-ga sipa-de$_3$-ne). The first of these 4 $^1/_3$ ma-na 2 gin$_2$ ku$_3$-babbar / siki-bi 43 gu$_2$ 40 ma-na "4 $^1/_3$ minas plus 2 shekels of silver, its wool is 43 talents and 40 minas" is conveyed by Ur-e'e (giri$_3$ ur-e$_{11}$-e). The second, 1 ½ ma-na la$_2$ 10 gin$_2$ ku$_3$-babbar / siki-bi 14 gu$_2$ 50 ma-na "1 ½ minas less 10 shekels of silver, its wool is 14 talents and 50 minas" is conveyed by Kas (giri$_3$ kas$_4$). The wool:silver ratio of the first of these payments is 10 ma-na siki :1 shekel silver and the second is 11:1. Both of these amounts are debited to the account of Lu-kala (ugu$_2$ lu$_2$-kal-la ba-a-gar). Lu-kala like his father Ur-e'e, the livestock administrator, is a member of the governing family of Umma (Dahl 2010:289) and one of the four major recipients of silver payments in that province (Ouyang 2013:97).

The second text in this group, MCS 8, 93, BM 105390, is a balanced account from Umma of wool for the year AS 9 (mu en ga-eš^{ki} ba-hun "Year when the en priestess was installed in Ga'eš") and concerning the activities of Kas the livestock administrator (kas$_4$ šuš$_3$). Kas is the livestock manager and overseer of the shepherds of the temple of Šara in Umma (Sallaberger 2014:05, Stępień 1996:51). The debits in the account almost certainly represent quantities of wool (totalling 26 gu$_2$ plus 42 ma-na) owed to the provincial government (the ensi$_2$) in respect of two earlier years AS 8 and AS 9 and which were still outstanding. Set against these amounts owed were two payments of silver in lieu of wool thus :$^2/_3$ ma-na ku$_3$ mu en ga-eš^{ki} ba-hun / $^5/_6$ ma-na ku$_3$-babbar mu ^{d}šu-^{d}suen lugal / siki-bi 18 gu$_2$/kišib$_3$ lu$_2$-kal-la "$^2/_3$ mina of silver in AS 9, $^5/_6$ mina of silver in SS 1 (the year when Šu-Suen became king), their wool equivalent is 18 talents, received (under seal of) by Lu-kala. The wool:silver ratio in this instance is 12 ma-na siki per shekel of silver. A further payment made in wool of 1 talent is received by Ur-Nintu (1 gu$_2$ siki / kišib$_3$ ur-^{d}nin-tu). There is little doubt about who Lu-kala is or of his role in this context, even though he is not specifically identified by patronymic. We are clear that he is an official of the administration and a member of the governing family. The identity of Ur-Nintu, another common name in the Umma onomasticon, is more difficult to establish. However, the fact that he receives wool under seal may suggest that he is operating in some capacity on behalf of the administration.[10] The payments still leave arrears on Kas's wool account of 7 gu$_2$ and 48 ma-na siki for the year AS 9, this even though the second payment of silver to Lu-Kala seems to have occurred in ŠS 1, the year after. The document, however, is dated mu ma$_2$ ^{d}en-ki ba-ab-du$_8$ "year when the boat of Enki was made" ŠS 3, which enables the ŠS 1 payment to be set against the previous year's account.

SANTAG 6, 269 is a balanced wool account from Umma and dated mu si-ma-[num$_2$^{ki}] ba-hul] "year Simanum was destroyed" (ŠS 3), accounting for wool transactions which were the responsibility of Ur-e'e, a chief livestock administrator and supervisor of the flocks and shepherds of some seven Umma temples (Sallaberger 2014:105). As we have seen he was also a member of the governing family of Umma and father of Lu-Kala. The total debits of the account comprise two large quantities, one of siki-kur-ra (31 gu$_2$ 42 $^5/_6$ ma-na) and the second of siki GI (160 gu$_2$ 30 ½ ma-na 8 gin$_2$). These quantities consist of a remainder (si-i$_3$-tum) of wool

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[10] It is highly likely that Ur-Nintu was an overseer (ugula) responsible for the supervision of female labour for various purposes and in ŠS 1 often in association with Lu-kala. The Umma text MVN 16, 0815 reads obverse / 10 geme$_2$ u$_4$ 1-še$_3$ / ša$_3$ e$_2$-maš-ka / siki igi sa$_6$-ga / ugula ur-^{d}nin-tu / kišib$_3$ lu$_2$-kal-la / reverse / iti ^{d}dumu-zi / seal impression / mu ^{d}šu-^{d}suen lugal. / seal / lu$_2$-kal-la / dub-sar / dumu ur-e$_{11}$-e šuš$_3$ "10 female workers(slaves) for 1 day, to sort wool at the sheepfold, supervisor Ur-Nintu, Lu-kala received, the month of the god Dumuzi, the year Šu-Suen became king (ŠS 1). Seal, Lu-kala, scribe, son of Ur-e'e chief livestock administrator. UTI 5, 3093 is an identical text except there are eleven female workers not ten. In the Umma text MVN 16, 1108 50 female workers for 6 days (geme$_2$ uš-bar bala-še$_3$ gen-na u$_3$ bala-ta gur-ra "female weavers sent to the bala and returned from the bala")) were supervised by ugula Ur-Nintu and authorised/under the seal of Lu-kala. In these texts Ur-Nintu supervises female labour in tasks of wool sorting and weaving but his female labourers were employed in other tasks as well. In UTI 5, 3126 Ur-Nintu provided and supervised 13 female labourers for one day's work to carry emmer wheat, received by Lu-Šulgira in month three of ŠS 1. Perhaps significantly, the document is sealed by the scribe Lu-Emah, son of Ur-Lisi the governor of Umma, suggesting that the labour is for work on behalf of the provincial government.

from both "mountain" sheep and native sheep, substantial amounts of wool from lah$_5$-sheep brought within Apisal (udu-lah$_5$ ša$_3$ a-pi$_4$-sal$_4$^{ki}),[11] wool plucked from sheep of the bala (siki udu bala-a ur$_4$-ra), arrears of wool of the shepherds supervised by Ur-e'e (la$_2$-ia$_3$ sipa-de$_3$-ne / ugula ur-e$_{11}$-e) and similarly from shepherds supervised by the livestock administrator Kas. The debits also include a considerable quantity of wool supplied by a third livestock administrator Ur-Nungal. Small amounts of wool are also supplied by a few individual shepherds. From these debits or available assets, wool is disbursed to the governor and as rations to female slaves employed by Ur-Nungal, to the Umma officials, Gududu (son of Dadaga the governor) and Egalesi, small disbursements are made to shepherds and perhaps as cultic offerings and on three occasions silver is paid to Lu-kala, a recipient of silver on behalf of the provincial government, totalling $^1/_3$ ma-na 7 $^1/_3$ gin$_2$ in lieu of 5 gu$_2$ 28 ma-na of wool. This is a wool:ratio of 12 ma-na siki per shekel of silver.

Even though the wool of these accounts is produced from flocks managed by the Umma temples, as noted by Stępień (1996:50) the accounting level is that of the central or provincial administration. The first in Table 2, indeed, is a wool account of the ensi$_2$ who in AS 3 was still Ur-Lisi, while since Ur-e'e supervised the flocks of some seven Umma temples, it is obvious that the wool accounts related to his activities were also produced by the provincial government rather than the temples. It follows that this is probably true of the much smaller account relating to Kas, the livestock administrator of the temple of the tutelary god, Šara. Although AAICAB 1/1, pl. 065-066, 1924-0666 and SANTAG 6, 269 are unfortunately not linked but are separated by some eight years in time, they do suggest that payments of silver in lieu of wool recorded in the wool accounts could be transfer payments between one governing institution and another. The disbursements or credits (zi-ga-am$_3$) in the governor's wool account include payments of silver in lieu of wool in respect of la$_2$-ia$_3$ su-ga sipa-de$_3$-ne "replaced arrears of the shepherds" made via Kas and Ur-e'e, both livestock administrators and overseers of shepherds, and ugu$_2$ lu$_2$-kal-la ba-a-gar "debited to the account of Lu-kala". The debits in the Ur-e'e wool account include large quantities of wool which were la$_2$-ia$_3$ su-ga sipa-de$_3$-ne "replaced arrears of the shepherds" under the supervision of Ur-e'e and Kas, while the credits include payment of silver in lieu of wool, this time kišib$_3$ lu$_2$-kal-la "received by Lu-kala". The idea is at least to be entertained that were we able to link the two levels of wool accounts with precisely related accounts, the nature of the payments as transfer payments, and as such involving no exchange of resources, would be confirmed.

Complementary book-keeping entries are made in the two levels of wool accounts tracking the replacement of deficits in wool quotas with silver payments into the coffers of the central administration. The sag-nig$_2$-gur$_{11}$-ra-kam (debits) of the governor's account represent the wool product of the flocks and associated wool revenues due to the province. They include quotas expected from the flocks of sheep as well as actual deliveries. The quantities of wool from the shepherds and their supervisors recorded in the debits are mostly prescribed quotas rather than actual deliveries. The shortfalls in meeting these quotas are set against these as

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[11] It is not clear what udu-lah$_5$(DU.DU) "lah$_5$ or DU.DU sheep" are. It's unlikely that they were a different breed of sheep since there may also have been lah$_5$(DU.DU) goats. AnOr 07, 157 has 18 udu 1 maš$_2$-lah$_5$(DU.DU) / babila$_2$-še$_3$ "18 sheep and 1 lah$_5$ goat for Babylon". See also UET 9, 1091. In SANTAG 6, 269 the amount of wool from the lah$_5$ sheep is almost certainly part of the siki GI summation rather than of the siki-kur-ra, indicating it is not a separate breed from udu eme-gi. In Nisaba 06, 20 siki udu nam-en-na and siki udu-lah$_5$ are both identified as siki GI. If we were to assume with Stępień that in Umma udu kur-ra were a mix of foreign breeds, then udu-lah$_5$ could be one of them, but then what about the goats? Neither of the texts with a maš$_2$-lah$_5$(DU.DU) is from Umma. The first is from Puzriš-Dagan while the second is from Ur. However, lah$_5$ is more likely to characterise the status of the sheep. In AAICAB 1/1, pl. 065-066, 1924-0666, and in other texts where both terms occur (Nisaba 06, 20, SET 130, SET 273), udu-lah$_5$ is contrasted with udu nam-en-na. nam-en-na is a "herd" or "flock". More specifically, it is the temple flock contracted to the care of a shepherd or shepherds, so that udu nam-en-na are those sheep which are animals already in the flock when allocated to shepherds for pasturing. udu-lah$_5$, on the other hand may be a term for those animals which are lah$_5$ "brought in" or added to the flock during their time on summer pastures. Stępień (1996:50) defines sipa udu-lah$_5$(DU.DU) as "shepherds who kept young animals", which of course will be so, since the udu-lah$_5$ are born in between the annual enumerations of the flocks.

la₂-ia₃ su-ga sipa-de₃-ne "arrears of the shepherds (to be) replaced" with silver, via their overseers and directed to the accounts of the managers of the province's silver revenues (here Lu-Kala). The la₂-ia₃ su-ga sipa-de₃-ne due from the overseers then appear in the debits of their accounts or perhaps only in the account of the most senior, Ur-e'e, who although designated šuš₃ performed several roles as a senior agricultural official as well as his occupation as a livestock administrator and supervisor of shepherds and herdsmen (Ouyang 2013:70). On the credit side of his account, silver from the shepherds is then actually paid to Lu-kala in lieu of their arrears of wool.

In this scenario, the equivalent silver value of the wool to be replaced is obviously determined by the central administration. At no point in the process is there an exchange of resources as the wool acquired by the governor is from his or the province's own flocks. Clearly shepherds were remunerated in some other way than via the exchange of silver for sheep and products from the flocks they were employed to herd. In addition to rations, they were most probably entitled to any natural increment to temple animals in their care which exceeded the growth of the flock, deliveries of wool and other products, required by institutional owners (Adams 2006:149). Animals surplus to these quotas could be added to their own flocks, which as Adams posited were in any event informally merged with those of the temple whilst these were in their care. Equally any deficits or arrears had to be paid in silver, which the shepherds could acquire from the sale of their own animals and wool.[12]

The fourth account in Table 2, while not a wool account recording the transactions of ruling officials in Umma, is made by the administration to document the restitution of arrears of wool which have been accumulated by Lu-saga over a period of some twenty years or more. AAICAB 1/1, pl. 041, 1911-237a-b is nig₂-ka₉-ak si-i₃-tum "a balanced account of remaining deficits". The account of lu₂-sa₆-ga dumu ur-ki-ag₂-mu contains debits totalling 3 talents 46 minas 14 $^1/_3$ shekels of siki GI, 10 minas of which is a balance brought forward from Š 42 and the remainder of which is owed from the year Š 44. 465 litres of barley in lieu of 18 ½ minas of wool is paid to Ur-Nungal the scribe son of the chief accountant in ŠS 7. 4 shekels of silver in lieu of 48 minas of wool via Ur-lugal and a further 13 $^1/_3$ shekels of silver in lieu of 2 talents and 40 minas of wool via is paid to Gududu (kišib₃ gu-du-du "Gududu received") and therefore the administration, in IS 2.[13] The 13 ½ shekels is raised from the sale by the administration of Lu-saga's wife and 3 of their children to Šara-izu who paid the silver to Gududu.

Lu-saga son of Urkiagmu was likely to have been the scribe and administrator in the Umma administration, who in one of his roles was a recipient of commodities ša₃ bala-a "within the bala" responsible for transferring them or ensuring their transfer by his subordinates to royal authorities or sending them to the bala (Sharlach 2004:42-6, 313).[14] Although there is no specific witness that Lu-saga received wool within the bala, it is clear

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[12] As Adams noted this is inferred from the attested sharecropping systems adopted by the temples and palaces of the Old Babylonian period (van de Mieroop 2002: 164). Herdsmen were given responsibility over a herd of animals to increase it by a predetermined number and to produce from it set quantities of products such as wool. Excess production in animals and produce became their own and they tended their own herds and those of the institutions together.

[13] Gududu, though not described as such here, is the scribe son of the ensi₂ Dadaga, confirmation of which is given by a seal in the IS 3 text MVN 16, 1043 in which Gududu receives a quantity of silver to replace arrears of barley. Gududu is one of the four major recipients of the Umma province's silver revenue (Ouyang 2013: 96-7).

[14] Lu₂-sa₆-ga, dub-sar, dumu ur-ki-ag₂-mu probably has a significant role within the bala system. However, I remain non-committal with regard to the precise meaning of ša₃ bala-a beyond the obvious "within the bala". Sharlach has her own interpretation that the phrase refers to the province's bala *payment* made within its appointed month whereas her reviewer, Dahl (2006:79-80), rejects this in favour of a wider consensus that the phrase refers primarily to a period of time. Some 13 texts from Amar-Suen 8 to Šu-Suen 3 testify to the role played by Lu-saga with respect to these within bala commodities. Of particular interest are UTI 4, 2762 in which

from BPOA 1, 1666 that the movement of wool was one of the commodities for which he was responsible.[15] It is a reasonable supposition therefore that his outstanding wool debt in AAICAB 1/1, pl. 041, 1911-237a-b results from his earlier failures to ensure the transfer to the crown or its servants some of wool he had received perhaps as a ša₃ bala-a commodity. He was probably liable for his own debts as well as those incurred by his subordinates, hence his wife and children were sold into slavery to redeem the debt owed to the crown or provincial administration (Wilcke 2005: 80). Lu-saga may have been dead when the debt was redeemed in IS 2, as his son, the scribe Inta'e'a, sealed the document (Ouyang 2013:40).[16]

The wool:silver price ratio in each of the payments of silver to Gududu in lieu of wool is 12 ma-na siki GI per shekel of silver. It is possible to infer from Figure 4, that by IS 2, the average value of wool may have fallen from 10 minas of wool per shekel to 12 minas per shekel. In this text as we have seen, and as in three others excerpted in Table 7, barley is also paid in lieu of wool. The wool:barley ratio is 12 ma-na per gur so that obviously a gur (300 sila₃) of barley is the equivalent of a shekel of silver. Thus in this text we have evidence that the barley:silver price ratio remained fixed at 300 sila₃ per shekel even though the value of wool with respect to either may have changed.

The correspondence of the wool:silver and the wool:barley price ratios substantiates the notion that these equivalent values are established by the governing administration, a probability which is further enhanced by the price paid by Šara-izu for the wife and children of Lu-saga. It is especially significant that the silver price of Lu-saga's family when sold into slavery is exactly or within 2% (if we assume that their price accounts for the small wool diri) of that required to redeem the outstanding amount of the wool debt. If it were otherwise, it could be assumed that this price was related to a market value of domestic slaves. This of course was never so. Debtors enslaved their families for only so long as it took to redeem the value of their debt, which here was settled in silver by their purchaser. The silver equivalence of the wool owed was fixed at 12 minas of wool to one shekel of silver by the creditors, the state and provincial government. As noted earlier, the wool:silver ratios in each of the accounts highlighted are similarly established by the administration.

Table 2. nig₂-ka₉-ak (siki) with silver paid in lieu of siki (GI)				
Text Sigla	*Subscript*	*Indicative phrases*	*Provenance*	*≈mean ma-na siki(GI) per shekel silver*
AAICAB 1/1, pl. 065-066, 1924-0666	nig₂-ka₉-ak siki, ensi₂-ka	šu-nigin₂ gu₂ siki hi-a, sag-nig₂-gur₁₁-ra-kam, ša₃-bi-ta, siki-ba Prof. N,	Umma	10

Lu-saga is the recipient of leather water bags for the royal entourage (followers) and supplies for Me-istaran, the king's daughter, "within the bala", and MVN 14, 0478 and BPOA 7, 2187 in which he is the recipient of ᵍᵉˢKA(zu₂)-ga-lum for the royal entourage, "within the bala". In SNAT 425 Lu-saga receives leather water bags for the royal entourage and provisions for a royal nursemaid, "within the bala" and in six texts he is the recipient of pots to hold five litres of ninda(GAR) "groats" (Damerow 2012:10 note 33) for the royal entourage, "within the bala". In UTI 4, 2752, He receives the services of 120 guruš for four days assigned to the royal storehouse in the processing of bitumen (gu₂-gir-ra e₂-šu-tum lugal gub-ba). Cf. UTI 4, 2500 for 4 ᵍᵉˢdusu/ gu₂-gir-ra-še₃ esir₂ ga₆-ga₆-de₃ "four baskets in order to carry bitumen for processing" which are ša₃ bala-a "within the bala commodities". Cf. MVN 11, 104 and MS 1725 to confirm the meaning gu₂-gir(-esir₂).

[15] In BPOA 1, 1666 NuKUda loads 6 minas of unsorted wool on a boat destined for Ur with the authorisation of Lu-saga (giri₃ lu₂-sa₆-ga).

[16] In the CDLI database, BPOA 1, 1666 from Š 39 is the first dated text sealed by Lu-saga and the latest is UTI 4, 2752 dated ŠS 3, so that it could be that Lu-saga had died up to eight years earlier than the redemption of his debt. His son the scribe Inta'e'a is unlikely to have been one of his three children sold into slavery, however.

		Table 2. nig$_2$-ka$_9$-ak (siki) with silver paid in lieu of siki (GI)		
		kišib$_3$ PN, kišib$_3$ ensi$_2$-ka, *n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, la$_2$-ia$_3$ su-ga sipa-de$_3$-ne, giri$_3$ ur-e$_{11}$-e, *n* gin2 ku$_3$-babbar, siki-bi *n* gu$_2$, la$_2$-ia$_3$ su-ga sipa-de$_3$-ne, giri$_3$ kas$_4$, ugu$_2$ lu$_2$-kal-la ba -a-[gar], ugu$_2$ dam-gar$_3$-ne ba-a-gar, zi-ga -am$_3$, la$_2$-ia$_3$ *n* gu$_2$ siki hi-a.		
MCS 8, 93, BM 105390	nig$_2$-ka$_9$-ak siki year date, kas$_4$ šuš$_3$	šu-nigin$_2$ *n* gu$_2$ siki, ša$_3$-bi-ta, *n* gin$_2$ ku$_3$(-babbar), siki-bi *n* gu$_2$, kišib$_3$ lu$_2$-kal-la, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	12
SANTAG 6, 269	nig$_2$-ka$_9$-ak siki ur-e$_{11}$-e	šu-nigin$_2$ *n* gu$_2$ siki, ša$_3$-bi-ta, *n* gin$_2$ ku$_3$, siki-bi *n* gu$_2$, kišib$_3$ lu$_2$-kal-la, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	12
AAICAB 1/1, pl. 041, 1911-237a-b	nig$_2$-ka$_9$-ak si-i$_3$-tum, PN1. (envelope) (seal).	šu-nigin$_2$ *n* gu$_2$ siki GI, ša$_3$-bi-ta, *n* gin$_2$ ku$_3$-babbar, siki-bi *n* ma-na, giri$_3$ PN2, *n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, sa$_{10}$-am$_3$ dam dumu PN1 3-a-ba giri$_3$ PN3, kišib$_3$ gu-du-du, zi -[ga], diri.	Umma	12

Payments of silver in lieu of siki (GI)

Of the seven texts excerpted in Table 3, six are from Umma and one from Nippur. CHEU 051 from Umma is undated while of the remainder are dated from Šulgi 37 to Amar-Suen 1. Two of these are date to Š 48. Arguably, all six of the Umma texts record payments of silver in lieu of wool to the central administration. Each of these payments is also formulated with the phrase *n* gin$_2$ ku$_3$-babbar / siki-bi *n* ma-na.

CHEU 051 lists deliveries of wool to replace deficits in wool quotas demanded of shepherds (la$_2$-ia$_3$-ta su-ga/sipa-de$_3$-ne/mu-ku$_x$(DU)). One of the deliveries by Hesage the shepherd/herdsman (na-gada) is a payment of seven shekels of silver in lieu of 70 minas of wool. The remaining five deliveries are made with wool. The quantity of wool equivalent to each shekel paid by Hesage was 10 minas, a wool:silver price ratio of 10:1. These deliveries were probably made to a livestock manager, possibly Ur-e'e, as witnessed in the wool accounts of the previous section and then transferred by him to the appropriate official recipient. In the case of the silver payment of the province's silver revenues this might well have been to Lu-kala, whereas the wool deliveries would be transferred to the governor's account and wool store.

[BIN 05, 149](#) from Šulgi 37 is formulated as a receipt in which Lugal-ebansa received six shekels of silver in lieu of one talent (60 minas) of wool from Inim-šara, a wool:silver price ratio of 10 minas wool:1 shekel silver. Inim-šara is readily identified as one of the shepherds listed in [CHEU 051](#) and it is highly likely that because he receives a payment of silver, Luga-ebansa is a high ranking official in the Umma administration. Indeed, Lugal-ebansa may possibly be a scribe son of Ur-Ištaran and is another recipient of $ša_3$ bala-a "within bala" commodities. His status as a senior official of the provincial government may be confirmed by his joint sealing with the $ensi_2$ of some of the $ša_3$ bala-a receipts.[17] In Š 37 he also received 2 talents of wool from Ur-Nisaba to exchange it for bitumen (siki $esir_2$-a sa_{10}-sa_{10}-de_3). The receipt was again sealed by Ur-lisi as well as Lugla-ebansa (see [AAICAB 1/1, pl. 031, 1911-217](#)).

In [JCS 54, 010, 68](#) dated Š 41, Dadaga, governor of Umma from ŠS 7 to IS 3, but at this time one of the four main recipients of the province's silver revenues and especially of the irrigation taxes, receives 50 $^2/_3$ shekels and 15 barleycorns of silver in place of 507 ½ minas of wool as a payment of an irrigation tax, a wool:silver price ratio of 10:1.[18] The 507 ½ mina is siki maš a-$ša_3$-ga "wool of the irrigation tax", which may seem unusual since the irrigation tax was normally paid in silver (Ouyang 2010:319 fn. 7). Prior to the silver payment being received by Dadaga ($kišib_3$ da-da-ga), the siki maš a-$ša_3$-ga was debited to the account of Ur-e'e (ugu_2 ur-e_{11}-e ba-a-gar) probably in his capacity as chief livestock manager ($šuš_3$). The fact that the tax was assessed as a quantity of wool suggests that it may be an irrigation tax due from a shepherd managed by Ur-e'e who paid the amount to the province's coffers in silver. But, why would a shepherd and his overseer have a liability for an irrigation tax? Despite a relative consensus that maš a-$ša_3$-ga in the Ur III texts is an irrigation tax or fee, it perhaps remains possible that as in Girsu maš a-$ša_3$-ga may have meant "rent of a field" if not paid in silver.[19] In [BPOA 1, 0342](#) from Girsu, the maš a-$ša_3$-ga is assessed as a quantity of wool (siki GI) and in the somewhat destroyed query Umma text [ViOr 8/1, 077](#) it appears to be assessed as 1 draught ox.

In [AnOr 01, 070](#) from Umma and dated Šulgi 48, Ur-Šara the chief accountant ($ša_{13}$-dub-ba) receives 10 shekels of silver in lieu of 100 minas of wool from Kas, in his capacity as livestock manager who oversees the flocks and shepherds of the temple of Šara. The wool:silver price ratio is again 10:1. Ur-Šara seems often to operate as an intermediary in transferring silver payments from the livestock managers and the final recipients of the province's silver revenue (Ouyang: 2013:71).

He probably also operates in the same capacity in [BPOA 1, 1776](#) which reads obv. / 10 gin_2 ku_3-babbar / siki-bi 1 gu_2 40 ma-na / sa_{10} ^{d}dumu-zi $arad_2$ ur-^{d}istaran sipa / e_2-gal-$še_3$ gen-na / rev. / ki i-di_3-^{d}iškur ugula / ki ur-e_{11}-e-ta / $kišib_3$ ur-^{d}šara$_2$ $ša_{13}$-dub-ba / mu ha-ar-ši^{ki} / ki-maš^{ki} ba-hul "10 shekels of silver, its wool 1 talent and 40 minas, the price of Dumuzi, the slave of Ur-Ištaran, shepherd, sent to the palace for Idi-Iškur the overseer, was received from Ur-e'e by Ur-Šara, the chief accountant. The year Harši and Kimaš were destroyed". It seems that the shepherd, Ur-Ištaran, had neither the wool nor the silver to pay to Ur-e'e and sold his slave to raise the amount required. Idi-Iškur at the palace bought the slave which enabled the probable debt to be redeemed. The wool:silver price ratio is 10 minas of wool per shekel of silver.

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[17] [BPOA 1, 1768](#) from Š 37 and [Aleppo 136](#) from Š 38 are sealed by both. The seals translate as "Lugal-ebansa, scribe, son of Ur-Ištaran, is your slave" and "Ur-lisi, governor, Umma".

[18] a-kal-la, da-da-ga, lu_2-kal-la and gu-du-du, all members of the ruling family of Umma (Dahl 2007:45 Figure 6), each received most of the irrigation taxes for separate periods of time perhaps suggesting that they successively led a governmental agency in Umma responsible for irrigation matters (Ouyang 2010:322).

[19] See Maekawa's dissenting view, *apud* Ouyang (2010:317, fn. 1), that in Lagaš maš a-$ša_3$-ga usually denotes the part of rent paid in silver at harvest by the lessee to the lessor.

The Umma text [SANTAG 6, 107](#) is a receipt dated AS 1. The ensi$_2$, the real owner of the flocks, received from Ur-e'e large quantities of both siki GI and siki kur-ra. He also received 144 shekels of silver in lieu of 1440 minas of wool, once again, a wool:silver ratio of 10:1.

[NATN 002](#) is a text from Nippur dated to Ibbi-Suen 2 and is a witnessed and sealed receipt (the seal is on the envelope) for $1\,^1/_3$ ma-na ku$_3$-babbar, siki-bi 20 gu$_2$ "80 shekels of silver, its wool 1200 minas". The wool:silver price ratio here is 15:1. It is impossible to suggest an acceptable prosopography which identifies and links the roles of the personnel named in the text and thus establishes whether this is an institutional or non-institutional transaction.

In contrast, it is quite apparent that the six Umma texts describe transactions with the Umma administration, substituting remittances of silver for wool in several situations. It is unremarkable, then, that in each example the equivalent value of 1 shekel of silver is 10 minas of wool, the "standard" price of wool in the latter years of Šulgi and early years of Amar-Suen, see Figure 4.

Table 3. Payments of silver in lieu of siki(GI)				
Text Sigla	*Subscript*	*Indicative phrases*	*Provenance*	*≈mean ma-na siki(GI) per shekel silver*
[NATN 002](#)	Date (witnessed) (envelope) (seal)	*n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, ki PN1-ta, PN2, šu ba-ti	Nippur	15
[BIN 05, 149](#)	Date	*n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, ki PN-ta, PN šu ba-ti.	Umma	10
[JCS 54, 10, 68](#)	Date	*n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, siki maš a-ša$_3$-ga, ugu$_3$ ur-e$_{11}$-e ba-a-gar, kišib$_3$ da-da-ga.	Umma	10
[AnOr 01, 070](#)	Date	*n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, ki kas$_4$-ta, kišib$_3$ ur-^{d}šara$_2$ ša$_{13}$-dub-ba	Umma	10
[BPOA 1, 1776](#)	Date	*n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, sa$_{10}$ PN arad$_2$ PN sipa, e$_2$-gal-še$_3$ gen-na, ki PN ugula, ki ur-e$_{11}$-e-ta, kišib$_3$ ur-^{d}šara$_2$ ša$_{13}$-dub-ba	Umma	10
[SANTAG 6, 107](#)	Date	*n* gin$_2$ ku$_3$-babbar, siki-bi *n* gu$_2$, ki ur-e$_{11}$-e-ta, ensi$_2$-ke$_4$, šu ba-ti	Umma	10
[CHEU 051](#)	la$_2$-ia$_3$-ta su-ga, sipa-de$_3$-ne, mu-ku$_x$(DU)	la$_2$-ia$_3$-ta su-ga, *n* gin$_2$ ku$_3$-babbar siki-bi *n* gu$_2$, PN na-gada	Umma	10

Payments and receipts of wool with silver equivalents

The texts in Table 4 are, perhaps with one exception, formulated as receipts of quantities of wool each with an equivalent value in silver and all except one are distinguished by the syntax *n* gu$_2$ siki (GI) / ku$_3$-bi *n* gin$_2$ / …šu ba-(an)-ti. Eight of these ten texts, have provenances in Umma, one is a Girsu text and one is sourced in Puzriš-Dagan, so that once again analysis is mainly valid for Umma. Most wool texts studied thus far clearly derive from activities of the central Umma administration and the same may also be true of several in this group.

Most obviously BPOA 7, 2279 dated Šulgi 38 month 10, is a receipt for a delivery of wool issued by a senior member of the governing administration. Ayakala, who like two of his brothers later became the ensi$_2$ of Umma, received 2 talents of siki GI with a value in silver of 14 shekels from Lugal-ezem via the merchant Ur-gigir. Ayakala sealed the document, a-kal-a, dub-sar, dumu ur-nigar^{gar} šuš$_3$, "Ayakala, scribe, son of Ur-nigar the chief livestock manager, which identifies him as the member of the governing family. Prior to his governorship in ŠS 7, while sealing documents as a scribe and son of Ur-nigar, Ayakala occupied senior positions in the Umma administration both as a recipient of the province's silver revenues and as a senior administrator "nam-ša$_3$-tam" of large areas of demesne land (Dahl 2007: 64 fn. 246).[20] Salesianum 4, 174 01, dated a month later is an equivalent text, though formulated a little differently. On this occasion, the same merchant receives 4 talents of wool from Lugal-ezem, kišib$_3$ a-kal-la "under the seal of/received by Ayakala". It is obvious that we are witnessing the same persons in each of the receipts even though Boson's 1942 copy of Salesianum 4, 174 01 appears to suggest the latter was not sealed.

It is certain that we know who Ayakala is in both texts and it is explicit that Ur-gigir is a merchant. Interpretation of both documents would be helped, however, if it were possible to identify Lugal-ezem, even though he has a very common PN in the Umma onomasticon. The evidence from both texts that wool is supplied by Lugal-ezem via the same merchant suggests he is probably a shepherd, which may be confirmed by Syracuse 452 rev. (i) 11-17. Unfortunately, this latter tablet is broken and there is no date available to verify contemporaneity with these two texts, but these lines read as follows: 131 gu$_2$ 8 ½ ma-na siki / blank space / mu-ku$_x$(DU) KA-x-KA / ki sipa-e-ne-ta / blank space / mu 2-kam / 4 gu$_2$ siki / ki lugal-ezem sipa-ta / ur-nigar^{gar} šuš$_3$ ib$_2$-gi-ne$_2$ "131 talents and 8 ½ minas of wool, delivery for PN? from the shepherds. In the second year, 4 talents of wool from the shepherd Lugal-ezem, Ur-nigar, the chief livestock manager, confirmed it". The association of Lugal-ezem with Ur-Nigar, šuš$_3$, a senior official of the Umma administration and paterfamilias of a branch of the governing family, suggests that he may have been employed via the temples to shepherd the state and province flocks.

BPOA 7, 2279 and Salesianum 4, 174 01 can be construed as receipts indicating the sale or exchange for silver, of wool destined to the administration via a merchant. It was noted earlier that shepherds employed by the institutions produced wool from their own flocks which they herded along with those of the institutions. From the sale of such wool to merchants, they obtained the silver with which to replace any arrears incurred in failing to meet required quotas of animals and wool. The need for the institutions, the main producers of wool, to purchase wool from the merchants to compensate for incidental shortages is posited by Ouyang (2013:147) and supported by Sallaberger (2014:97) though neither points to the institutions' own shepherds as the source of the wool purchased.

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[20] Attested in the Šulgi 47 text, Princeton 2, 497, in which labour hired for 39 days to do earth moving in a demesne field, was paid wages of barley and managed by the overseer (ugula) inim-šara$_2$ dumu ur-nigar^{gar}, a brother of Ayakala. The hiring is under the seal of the senior demesne administrator Ayakala, overseer, (kišib$_3$ nam-ša$_3$-tam a-kal-la nu-banda$_3$) and the document has the seal a-kal-la/dub-sar/dumu ur-nigar^{gar} šuš$_3$).

The sale of wool by a shepherd to a merchant, should this be implied by these receipts, may account, in this instance, for a wool:silver price ratio of approximately 9 minas of wool to 1 shekel of silver.[21] This compares with the 10:1 ratio characteristic of the payments of silver in lieu of wool made directly to the provincial administration and excerpted in table 3. The wool:silver ratios in those texts were probably fixed by the institutions and were the so-called "standard" or average until about AS 8. There may be the suggestion here that when a shepherd sold his own produce to a merchant, he could ask and get a higher silver price for his wool. A wool:silver ratio of 9:1 rather than 10:1 represents a 10% higher relative price than the average value.

There are considerable difficulties to be overcome in the interpretation of Nisaba 15, 1120.[22] Nevertheless, it is perhaps possible to derive a context from it. The five lines of text which are purported to be located on the left edge of the tablet[23] suggest that it is a primary document prepared by the Umma administration regarding transactions of the merchant Lu-Šara, which later become entries in a balanced account of his transactions.

Dahl (2010 :278-9), abridging Englund (1990: Chapter 1) on the merchant accounts, considered that the their terminology, and that of the genre of balanced accounts, simply relates to their physical structure, rather than defining the nature of the goods, so that it is better to think of the "first section", sag-nig_2-gur_{11}-ra-kam, as "debits" rather than "capital" or "assets available" and the second section framed by $ša_3$-bi-ta "from its middle"… zi-ga-am_3 "torn out/booked out" as "credits" but nevertheless, Dahl follows Englund (1990) in considering that the merchant accounts "calculated the rate at which the trade agent converted *the "goods", put at his disposition by certain agencies of the state*, into commodities sought by the same or other agencies of the state. The receipts for the withdrawals made by officials of these various state agencies from the merchant, were presented to the administration once or twice a year and the quantities of goods withdrawn and their silver values were entered in the "credit" side of the merchant's balanced account.[24]

It seems reasonable to suppose that in between receipts held by the merchant and the *Sammelurkunde* which was the balanced merchant account there would be smaller documents which collected some of the transactions made with institutions by merchants. Nisaba 15, 1120, possibly to be dated circa Š 40, may be such an intermediate document.[25] It records that as well as small quantities of sesame oil, received by him or

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[21] In BPOA 7, 2279 the ratio is in fact 8.6:1 but is rounded up in table 4.

[22] At the time of writing it remains impossible to compare David Owen's edition of the text which exists in transliteration only with an image of the tablet. Without a copy or a photograph, it is difficult to achieve a narrative which makes complete sense.

[23] Compare the versions in the CDLI database (P454238) and Manuel Molińa's version of the edition in the BDTNS.

[24] A search of the Umma Ur III texts in the CDLI database on "dam-gar_3-ta, šu ba-ti" produces 14 receipts recording the supply of various commodities to officials of the provincial administration.

[25] A guide to its probable dating and context is provided by the Umma text AUCT 2, 173, which conformably translates as: $^2/_3$ shekel less 12 barleycorns of gold, its silver 4 shekels, 2 shekels silver, Dannegi, 7 litres good sesame oil, its silver 1 ½ shekels, Daya, 4 litres sesame oil, its silver ½ shekel, the first time, 10 minas cypress (for fragrance production), its silver 1 ½ shekels the second time, Lu-Gula, 2 litres pig fat its silver ¼ shekel, Izbum fuller, total 9 ¾ shekels (silver), withdrawn/booked out from Lu-Šara, month 5, the year after the year (in which) the temple of Puzriš-Dagan (was built) (Š 40). This text itemises several commodities, all of which tend to be supplied to institutions by merchants rather than produced in-house and which are withdrawn from Lu-Šara by probable officials of the administration. Two of these officials are Lu-Gula and Daya. That Lu-Šara is a merchant is attested in Nisaba 15, 1120 in which Lu-Gula and Daya are the two officials who perhaps withdraw commodities from Lu-Šara. Such an interpretation is only possible if it is argued that there is an element of congruency with AUCT 2, 173. The edition of Nisaba 15, 1120 reads as follows: obv: 30 ma-na siki (GI) / ku_3-bi 4 gin_2 / 1 $sila_3$ i_3-geš du_{10}-ga / ku_3-bi igi 6-gal_2 6 še / 1 $sila_3$ i_3-geš / ku_3-bi 3 igi še / rev: ku_3-bi 20 / blank line / lu_2-gu-la / 5 $sila_3$ i_3-geš du_{10}-ga / ku_3-bi 1 gin_2 / inim lu_2-gu-la / da-a-a / šu ba-ti / 2 $sila_3$ i_3-geš du_{10}-ga 11 še / left edge: šu-$nigin_2$ 5 ½ gin_2 ku_3 / ki lu_2-$šara_2$ dam-gar_3-ta / lu_2-du_{10}-ga / šu ba-ti / iti dal / Seal illegible. English

at his instruction, Lu-Gula perhaps withdrew/booked out 30 minas of wool (siki GI) equivalent in value to 4 shekels of silver from Lu-Šara the merchant. The wool:silver price ratio in this instance is 7 ½ minas per shekel a "price" some 1 ½ minas per shekel higher than a merchant paid to shepherds to acquire the wool in our earlier example.[26]

UTI 6, 3778 is an unsealed document of Umma provenance dated Šulgi 35. It receipts 1 talent of siki GI the equivalent in silver of which is 7 ½ shekels, a wool:silver price ratio of 8 mina of wool per shekel of silver.

Both AUCT 3, 313 and AUCT 3, 251 were discussed earlier as each is a receipt of siki kur-ra as well as siki GI received from the official ur_4-$ša_3$-ki-du_{10} and each attests a wool:silver price ratio of 10:1 for both siki kur-ra and siki GI. The broken text CST 595 also receipts wool acquired from ur_4-$ša_3$-ki-du_{10} in return for silver. As we saw earlier in OrSP 06, 59 Wengler 45, the silver may not solely be simply an accounting value of the

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translation: "30 minas wool (from native sheep), its silver 4 shekels, 1 litre good sesame oil, its silver $^1/_6$ shekel and 6 barleycorns, 1 litre sesame oil, its silver 3 *opposite* (reciprocal) barleycorns, its silver 20, blank, Lu-Gula, 5 litres good sesame oil, its silver 1 shekel, on the instructions of Lu-Gula, Daya, received, 2 litres good sesame oil, 11 barleycorns. Total: 5 ½ shekels silver, from Lu-Šara merchant, Lu-duga, received, Umma month 5. The presence of Lu-Gala, Daya and Lu-Šara in the text and its month date, iti dal, suggest that the text may be contemporary with AUCT 2, 173 and is from Umma in Š 40. The overall interpretation of the text, however, is a little different from that of this possible contemporary. It is arguable that Lu-Gula and, on his instruction, Daya withdrew wool and oil from the merchant Lu-Šara, the equivalent value in silver of these commodities, which would have been reimbursed to him in silver, was then paid to Lu-duga in month 5. It is unfortunate that the seal on this tablet appears to be illegible, but it is likely that if Lu-duga received silver from the merchant, the seal was his. It is also possible that at this date, Lu-duga, possibly the son of Nigar-kidu, was a proxy for Dadaga (Dahl 2007:48) who was one of the major recipients of the silver revenues of the provincial administration.

This interpretation of Nisaba 15, 1120, however, is a reconstruction of a problematic edition of the text. A first obvious indication that the edition may not represent an accurate transliteration of the cuneiform is evident from the lines obv. 5-rev.1. 1 $sila_3$ i_3-geš / ku_3-bi 3 igi še / ku_3-bi 20 which suggest, most improbably, that the scribe constructed the value of the silver equivalent via a table of sexagesimal reciprocals (see MKT 1, 010, HS 0201obv. (i) 3. [3] igi 20 and obv (ii) 4. 20 igi 3, and Friberg (2005:9, 2007:68) proposing that this is an Ur III table). The conjectured mash-up of a reciprocal is probably only plausible if we adopt Powell's arguments (Friberg 2005:8, Robson 2008:78) regarding the "scratch pad" quality of YOS 04, 293 and particularly that "calculations in sexagesimal notation were made on temporary tablets which were then moistened and erased for reuse after the calculation had been transferred to an archival document in standard notation". It could then perhaps be argued in respect of Nisaba 15, 1120, which is assumed to be an administrative text, that the scribe in making a transfer of this kind had inadvertently transferred some of his computation rather than a finished calculation. It is otherwise difficult to imagine why or how a weight of silver of 20 barleycorns would come to be written 3 igi 20 še, if that is indeed the case, even though it is likely that quantities of silver as small as this were probably computed for the purposes of bookkeeping, not weighed (Friberg 2007: 109).

Secondly, rev. 8 (lower edge in the BDTNS version) 2 $sila_3$ i_3-geš du_{10}-ga 11 še is probably incomplete. It could perhaps be 2 $sila_3$ i_3-geš du_{10}-ga 11 še[-ta] "2 litres of good sesame oil at 11 barleycorns of silver each (litre)". It is then possible that there may be a further line on the bottom edge of the tablet which is the silver equivalent of 2 litres of sesame oil, [ku_3-bi 22 še]. Nevertheless, 11 barleycorns per litre of sesame oil is a very low price in the context of both Nisaba 15, 1120 and AUCT 2, 173. In these two similar and related texts the silver equivalents of sesame oil possibly range from 20-38 barleycorns per litre. Uncertainty around the numbers in our text is emphasised by the fact that the silver equivalents don't add to the total given at line 1 on the left edge.

Finally, five lines written on the left edge imply an unusually thick tablet for an administrative account, but perhaps not for an exercise tablet or Powell's "scratch pad". Nonetheless, their location there, remains plausible if we consider the shape and dimensions of its supposed "sibling", AUCT 2, 173. The CDLI photograph shows that the reverse of that tablet overflows three lines onto the bottom edge and the tablet is probably thick enough to accommodate 5 lines. Because when inscribing the tablet, the scribe of necessity overflows long lines onto the right-hand edge, it leaves the left edge free until he has filled the reverse, so that there would have been space for five lines on that edge of a similar tablet.

[26] Rounded up to 8: 1 in table 4, i.e. to the nearest mina per shekel.

wool but may have actually been exchanged for the wool but was not delivered, nu-mu-ku$_x$(DU). The wool on the other hand appears to have been transferred to the recipient. The wool:silver ratio was again 10:1.

The table 4 texts from Girsu and Puzriš-Dagan are both probably receipts of wool supplied by the central institutions and both attest a wool:silver ratio of 10 minas per shekel of silver. The Girsu text, SNAT 028, is dated Šulgi 44, which records receipts for two quite separate transactions. In the first, a quantity of silver, acquired from the trade of dates of Guabba (ku$_3$ zu$_2$-lum gu$_2$-ab-ba^{ki}-ka), was received by Ur-Ba'U the sanga of the temple of Ninmar.KI (ur-^{d}ba-ba$_6$ sanga ^{d}nin-mar^{ki}), which as the trade in dates suggests was probably located in Guabba (see Vermaak 2008: 463 fn. 30 and TUT 072 obv.2 eš$_3$-eš$_3$ ^{d}nin-mar^{ki} gu$_2$-ab-ba^{ki} "festival of the goddess Ninmar.KI in Guabba") and in the second a large quantity, 60 talents of wool (siki GI) equivalent to 6 minas of silver is (received) by Idi-Suen from Lu-Ningirsu, son of Aradmu. Although the name Idi-Suen has only this one attestation in the CDLI transliterations of Ur III Girsu texts, lu$_2$-^{d}nin-gir$_2$-su dumu ARAD$_2$-mu is a scribe; see the AS 3 text, UNT 096. The presence of both a temple sanga and a scribe in this text points to an institutional context. Similarly, in Aleppo 482, a large quantity of wool with a wool:silver equivalent ratio of 10:1 is received from a governor and thus is certain to refer to a transaction by an institution.

Table 4. Payments / Receipts of siki(GI) with silver equivalents				
Text Sigla	*Subscript*	*Indicative phrases*	*Provenance*	*≈mean ma-na siki(GI) per shekel silver*
SNAT 028	Date	*n* gu$_2$ siki, ku$_3$-bi *n* gin$_2$, ki PN1-ta, PN2	Girsu	10
Aleppo 482	Date	*n* gu$_2$ siki, ku$_3$-bi *n* gin$_2$, ki ensi$_2$-ta, PN1, šu ba-ti	Puzriš-Dagan	10
UTI 6, 3778	Date	*n* gu$_2$ siki, ku$_3$-bi n gin$_2$, ki PN1-ta, PN2 šu ba-ti	Umma	8
BPOA 7, 2279	Date (seal: a-kal-a, dub-sar, dumu ur-nigar^{gar} šuš$_3$)	*n* gu$_2$ siki GI gal! ku$_3$-bi *n* gin$_2$, ki PN1-ta, a-kal-a, šu ba-ti	Umma	9
Salesianum 4, 174 01	Date	*n* gu$_2$ siki, ku$_3$-bi *n* gin$_2$, ki PN1-ta, PN2 šu ba-ti	Umma	9
Nik 2, 390	Date	*n* ma-na [siki] GI, ku$_3$-bi *n* gin$_2$, ki PN1-ta, PN2 šu ba-ti	Umma	9
AUCT 3, 313	Date (seal)	*n* ma-na siki, ku$_3$-bi *n* gin$_2$, ki PN*-ta, PN1 šu ba-ti	Umma	10
AUCT 3, 251	Date (seal)	*n* ma-na siki, ku$_3$-bi *n* gin$_2$, ki PN*-ta, PN1 šu ba-an-ti	Umma	10
CST 595	Broken date	*n* ma-na siki, ku$_3$-bi *n* gin$_2$ nu-mu-ku$_x$(DU), ki PN*-ta, PN1, PN2 [šu] ba-an-ti	Umma	10

Table 4. Payments / Receipts of siki(GI) with silver equivalents				
Text Sigla	Subscript	Indicative phrases	Provenance	≈mean ma-na siki(GI) per shekel silver
Nisaba 15, 1120	Month date	n ma-na siki, ku$_3$-bi n gin$_2$, PN1, inim PN1, PN2 šu ba-ti, ki PN3 dam-gar3, PN1, šu ba-ti	Umma	8

Miscellaneous expenditures of wool with silver equivalents

The six texts in Table 5 are a miscellany of documents, some balanced accounts, others related to the genre or not, but all contain a wool:silver ratio. Nisaba 07, 36 dated Šulgi 38 is a balanced account from Girsu, which is subscribed ur-sa$_6$-ga nu-banda$_3$ gu-za-la$_2$ "Usaga. overseer of throne bearers". The "available assets" debited in the account comprise silver and aromatics brought forward as the previous deficit of the account and quantities of dates and wool converted to a silver value which are supplemented with additional silver both to fund barley wages of labourers for earth works perhaps on canals and harvesting and the supply of bitumen, probably for the work on the canals. The wool of the sag-nig$_2$-gur$_{11}$-kam is entered at obv. (i) 6-7 as 10 gu$_2$ siki GI 10! ma-na-ta / ku$_3$-bi 1 ma-na "10 talents (600 minas) of wool (of native sheep) at 1 shekel of silver per 10 minas, its silver 1 mina (60 shekels). The wool:silver price ratio is then 10 minas per shekel. A wool:silver equivalent is also present in the "credits" or expenditures of this account. Obv. (i) 2-3, assuming again that 1 shekel of silver is equivalent to 10 minas of wool, may be restored as 175 gu$_2$ siki   [GI 10 ma-na]-ta / ku$_3$-bi 17! ½ ma -[na] "175 talents (10,500 minas) wool (of native sheep) at 1 shekel per 10 minas, its silver 17 ½ minas (1050 shekels). The institutional context of the account is established by the office of the person, an overseer of the throne bearers, responsible for it.

In CT 07, pl. 46, BM 017772, a Girsu text dated Šulgi 48, a total of 101 talents and 8 $^1/_3$ minas of wool with a silver equivalent of 10 minas and 6 $^5/_6$ shekels (converted at 10 minas of wool per shekel of silver) and supplied by Lu-Ningirsu in successive years Š 47 and Š 48 was exchanged for quantities of copper which were transferred to a smith (ugu$_2$ ur-^{d}geš-zi-da simug ba-a-gar). The silver value of the copper was balanced with that of the wool in a nig$_2$-ka$_9$-ak uruda sa$_{10}$-a "balanced account of copper exchanged". The account was made giri$_3$ sanga ^{d}nin-mar^{ki} via "with the authority of a chief administrator of the temple of Ninmar.KI". Lu-Ningirsu was attested in the Š 44 receipt SNAT 028 of Girsu provenance, as was a named sanga of the same temple. There seems little doubt that the same sanga occurs in both texts. The wool:silver price ratio is again 10:1.

The remaining four texts in Table 5 have provenances in Umma. AUCT 1, 444 has already been discussed as it records both the non-delivery of "old" siki GI and the delivery by a merchant of new siki kur-ra. The different types of wool appear to have come from the storehouses of separate temple establishments. The siki GI: silver price ratio is on this occasion 12:1, which since the texts is dated to ŠS 2 may be the average relative price of siki GI at that time, cf. Figure 4.

SANTAG 6, 381, subscribed diri la$_2$-ia$_3$ nig$_2$-ka$_9$-ak siki-ka / a-du, is an account which balances the surpluses and deficits which have presumably accrued in previous balanced wool accounts of Adu. The "debits" of the account comprise substantial quantities of 3rd and 4th quality woollen textiles, bundles of unretted flax stalks, 20 litres of alkaline plants, the total value of which is 14 $^1/_3$ shekels and 16 barleycorns of silver: la$_2$-ia$_3$-am$_3$ "being the deficit". The "credits" are quantities of three different grades of wool. They consist of 7 minas and 2 shekels of siki GI "wool of native sheep", the silver value of which is $^2/_3$ of a shekel and 21 barleycorns, 18 $^1/_3$ minas of siki ge6 "wool from black sheep", the silver value of which is 2 $^5/_6$ shekels, and 6 $^2/_3$ minas and 3 shekels of siki mug "wool of poor quality", the silver value of which is $^1/_3$ of a shekel. The total silver value of the "credits" is 3 $^5/_6$ shekels and 21 barleycorns. When set against the "debits" this still leaves a substantial

deficit (la$_2$-ia$_3$) of 10 $^1/_3$ shekels and 25 barleycorns of silver, which Adu must repay at some point. The respective wool:silver price ratios are 9 minas wool :1shekel silver for siki GI, 10:1 for siki ge$_6$ and 20:1 for siki mug in what seems certain to be an account of the Umma institutions.

The Umma text, TCL 05, 6171, is an account of an institutional household which lists (obv. 1-rev. 2) the workdays of labour performed by guruš for various monthly periods probably in Šulgi 34 the year date of the account. Rev. 3-9 lists 3 payments to Lugal-ezem their overseer, who no doubt supplied the gurus for the work. The first payment is of barley, the second of silver and the third is of wool. An equivalent value in workdays is associated with each payment, thus including the valuation of inputs of labour into the general equivalence system of the Ur III period (Englund 2012b: 127-8). The workday equivalents for each of these commodities in this text are 80 workdays per gur of barley: 90 workdays per shekel of silver and 90 workdays per 8 minas of wool (siki GI), therefore the barley:silver ratio is 337.5 litres of barley per shekel of silver and the wool:silver ratio is 8 minas of wool per shekel of silver. The workdays associated with these payments of barley, silver and wool do not seem related to the workdays performed by the guruš and recorded in the first part of the text. These add to 5160 workdays, whereas the workdays equivalent to the payments to Lugal-ezem total 6375, a difference of 1215 workdays. The value of a labourer's work and the calendar were fixed by the administration and equivalences varied with different types of work (Dahl 2005:279). Such standardisation may contribute to the discrepancy in these totals but it is more likely that the different parts of the text are unrelated sections extracted from institutional accounts related to Lugal-ezem. The subscript nig$_2$-ka$_9$ lugal-ezem-ta "from account(s) of Lugal-ezem" clearly suggests this.

VDI 1976/3, 110-111 from Umma dated AS 4 is a list of zi-ga bala-a "expenditures of the bala", a phrase which "apparently refers to materials expended on behalf of the government of the central government" (Sharlach 2004:34). The commodities listed in the first part of the document comprise relatively small quantities of aromatics, reeds, bappir and malted bappir, ghee, goat's cheese, dates and raisins. Rev. 6-18, appear to be totals of most of these commodities, but are difficult to reconcile with the numbers given in the first part of the document. Each commodity total is associated with an equivalent value in silver. However, there are commodities in this section of the text which are not present in the preceding list. In particular, and the only one of relevance here, is an entry for a total of 1 mina of wool (siki) with a silver equivalent value of 18 barleycorns which gives a wool:silver price ratio of 10 minas of wool per shekel of silver.

Table 5. Miscellaneous expenditures/deliveries of siki(GI) with silver equivalents				
Text Sigla	Subscript	Indicative phrases	Provenance	≈mean ma-na siki(GI) per shekel silver
Nisaba 07, 36	la$_2$-ia$_3$-am, ur-sa$_6$-ga nu-banda$_3$ gu-za-la$_2$	si-i$_3$-tum nig$_2$-ka$_9$-ak, n gu$_2$ siki GI 1(0?) ma-na-ta, ku$_3$-bi n ma-na, sag - [nig$_2$]-gur$_{11}$-ra-kam, ša$_3$-bi-ta, zi-ga, la$_2$-ia$_3$-am$_3$	Girsu	10
CT 07, pl. 46, BM 017772	nig$_2$-ka$_9$-ak uruda sa$_{10}$-a, giri$_3$ sanga TN	šu-nigin$_2$ n gu$_2$ siki 10 ma-na-ta, ku$_3$-bi n gin$_2$, ki PN-ta, ša$_3$-bi-ta, zi-ga	Girsu	10
AUCT 1, 444	e$_2$-kišib$_3$-ba ki-tuš e$_2$-la$_2$ u$_3$ e$_2$-kišib$_3$-ba pa-pah-ta	n ma-na [siki] GI sumun, ku$_3$-bi n gin$_2$, nu-mu-ku$_x$(DU), PN dam-gar$_3$ mu-ku$_x$(DU)	Umma	12
SANTAG 6, 381	diri la$_2$-ia$_3$ nig$_2$-ka$_9$-ak siki-ka, PN	n ma-na siki GI, ku$_3$-bi n gin$_2$, n ma-na siki ge$_6$, ku$_3$-bi n gin$_2$, n ma-na siki mug, ku$_3$-bi n gin$_2$, diri-ga-am$_3$, la$_2$-ia$_3$	Umma	9
TCL 05, 6171	nig$_2$-ka$_9$ PN-ta	n gurus, iti n-še$_3$, a$_2$-bi n, n gu$_2$ siki GI, ku$_3$-bi n gin$_2$, a$_2$-bi n.	Umma	8
VDI 1976/3, 110-111	zi-ga bala-a	šu-nigin$_2$ n ma-na siki, ku$_3$-bi n gin$_2$,	Umma	10

Wool trades by institutional households via merchants

Of the 48 separate texts from which a wool:silver ratio (siki GI: ku$_3$(-babbar)) can be computed, 21 or 44% are balanced merchant accounts from Umma and with few exceptions are typified by the usual syntax of the Ur III balanced account, (si-i$_3$-tum)/(sag-nig$_2$-gur$_{11}$-ra-kam)/ša$_3$-bi-ta….zi-ga-am$_3$/(la$_2$-ia$_3$/diri) and subscripted nig$_2$-ka$_9$-ak PN (dam-gar$_3$).[27] The unit of account is always ku$_3$-bi "its silver" so that the equivalent value of wool is computed from the generic phrase n gu$_2$ siki / ku$_3$-bi n ma-na as opposed to n ma-na ku$_3$(-babbar) / siki-bi n gu$_2$ siki (GI). Twenty of these merchant texts are transliterated in the CDLI database. Since Snell included UMM 2275 in his table 6, I have included it here also, even though in the CDLI database it is available as a photograph only.[28] There is one entry on the tablet in respect of wool, an item in the sag-nig$_2$-gur$_{11}$-ra-kam "debits" of the text. Obv. (i) 5-6; 12 gu$_2$ siki GI / ku$_3$-bi 1 ma-na "12 talents of wool (from native sheep), its silver 1 mina" represents a wool:silver price ratio of 12 minas of wool for each shekel of silver. A deficit valued in silver is brought forward into the debits from the year previous (si-i$_3$-tum mu en eridu^{ki} ba-hun "deficit carried forward from the year when the en-priestess of Eridu was installed) to which the text is

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[27] TCL 05, 6046 in Table 6, doesn't have the usual subscript but is included as a merchant account, though it is more probably an account of the overseers of the Umma merchants (see Englund (1990: 200), also my discussion of TCL 05, 6037 and associated footnote). Rev. (ii) 17-19 reads; (blank space) i$_3$-šah$_2$ gur / i$_3$-sa$_{10}$-sa$_{10}$ / sag-nig$_2$-gur$_{11}$-ra dam-gar$_3$-ne "$n?$ litres of pig fat will be exchanged with goods put at the disposal ("debits") of the merchants". Nor is the account a balanced account. The total silver value of the debits section is much more than the value of the goods booked out in the "credits". Following the total zi-ga-am$_3$ the silver value of the excess of the debits over the credits, the "deficit" (la$_2$-ia$_3$), is normally entered to balance the account. It may be that because rev. (ii) 17-19 foresees further expenditure to be made from the debited items, the account records work in progress. On the other hand, it may be impossible to assign responsibility for a "deficit" to a collective of merchants rather than a single individual.

[28] See Snell (1982: 180) where it is included in his table as AS9xPd which in his table 1 on page 16 is decodified as Mississippi 3.

dated in the subscript at rev. (ii) 4-6; nig$_2$-ka$_9$-ak pa$_3$-da / iti ezem-^{d}šul-gi / mu en ^{d}nanna kar-zi-da ba-hun "account of Pada, month of the festival of Šulgi (month 10), the year the en-priestess of Nanna in Karzida was installed (Amar-Suen 9). Pada the merchant (pa$_3$-da dam-gar$_3$) is well attested in the Umma merchant accounts.

In nineteen of the twenty-one merchant accounts in Table 6, wool and its associated silver equivalence is entered as a debit in the sag-nig$_2$-gur$_{11}$-ra-kam section of the account and is thus "assets" or "goods put at the disposition" of the merchant by the institutional households of the province to trade for other commodities required by members of these households. It is evident from two only of the merchant accounts that the institutions occasionally made purchases of wool via the merchants. Sallaberger (2014:97) in agreement with Ouyang, as I noted earlier, suggests that these purchases from other sources, forced on the governor's organisation, resulted from temporary shortages of the wool produced by the temples. Ouyang (2013:146) considered that these shortages in the supply of wool could perhaps mainly be ascribed to the reign of Šu-Suen, a proposition which probably needs revision given the possible decrease in the value of wool relative to silver from around Amar-Suen 7 onwards, cf. Figures 3 and 4. A lower "price" does not suggest a supply shortage. However, I return to this issue in discussing variations in the price ratio later. In the ŠS 6 text TCL 05, 6037 obv. (i) 8, the governing households earmarked resources which the merchants were required to exchange for wool. Here, 420 gur še sa$_{10}$-am$_3$ siki "126,000 litres of barley to exchange for wool" were debited in the sag-nig$_2$-gur$_{11}$-ra-kam section of the account. But also, two separate transactions of wool are booked out/withdrawn from the merchants and entered in the "credits" in the merchant account. The first is recorded at rev. (iv) 39-rev. (v) 1; 16 gu$_2$ 40 ma-na siki / ku$_3$-bi 2 ma-na, which is a wool:silver "price ratio" of 8 minas per 1 shekel of silver. The second, rev. (v) 2-3; 14 gu$_2$ 25 $^2/_3$ ma-na siki / ku$_3$-bi 1 ma-na 12 gin$_2$ 25 še translates to a wool:silver ratio of 12:1. The average of the two ratios is thus 10:1 as given in table 6. Each individual ratio is given in the Appendix, however, and charted in Figures 3 and 4. Both withdrawals of wool from the merchants were debited to a wool account (nig$_2$-ka$_9$ siki-ka ugu$_2$-a ba-a-gar). Nonetheless, the account represented by this text is a balanced account of the merchants overseen by Lu-kala (nig$_2$-ka$_9$-ak dam-gar$_3$-ne / lu$_2$-kal-la).[29]

Although SNAT 504 also dated ŠS 6 is subscripted nig$_2$-ka$_9$ dam-gar$_3$ lu$_2$-^{d}ha-ia$_3$ "account of the merchant Lu-Haya", the text lists only items which were withdrawn/booked out (zi-ga-am$_3$) from the merchant by officials. These would normally represent the credits in a fully balanced account. The tablet may therefore be work in progress on a merchant account under development. In a part of the list consisting of the withdrawals of aromatics, oils, copper and bitumen and which are nig$_2$-dab$_5$ ma$_2$-gur$_8$ ^{d}šara$_2$ "requisitions from the Šara temple barge", one entry (rev. 4-5) of 10 gu$_2$ 33 $^1/_3$ ma-na siki / ku$_3$-bi $^2/_3$ ma-na 7 ½ gin$_2$ "10 talents and 33 $^1/_3$ minas wool, its silver 2/3 mina 7 ½ shekels produces a wool;silver ratio of 13:1.

In the nineteen merchant accounts where quantities of wool and their equivalent values in silver are listed in the "debits" (sag-nig$_2$-gur$_{11}$-ra-kam), six have two or more such entries. In table 6, the average of the ratios computed for each of these texts is given, but as before each of the values is included in figures 3 and 4 and in the Appendix. The mean wool:silver "price ratio in the merchant texts is 10 minas ± 1 mina of wool siki GI) per shekel of silver , the median of the distribution is also 10:1.

As we have seen, all but three of the observations of the ratio occur in the sag-nig$_2$-gur$_{11}$-ra-kam "debit" section of the merchant accounts. To reiterate, this section of the merchant account records state or provincial

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[29] For the prosopography of Lu-kala and his possible status as šabra see Dahl (2007:105-113 and for Lu-kala specifically as the overseer of the Umma colony of trade agents (merchants) see Dahl (2007:112).

resources, perhaps surpluses of barley, wool, dates etc. produced by the governing administration, as well as silver, made available to the merchant to trade for commodities not produced by institutional households but demanded by differing parts of the provincial and state administrations. The commodities for which surpluses were exchanged were recorded in the "credit" or ša₃-bi-ta…. zi-ga-am₃ section. The respective values of the debits and credits were compared via the application of silver equivalences (ku₃-bi) to the quantities of commodities in each section of the account.

The issue of how these equivalents were estimated, whether via an unlikely pricing mechanism in a market or set by governing administration is central to this study. The issue is considered more fully in discussing variations in the wool:silver price ratio. However, the "debit" section of [YNER 08, 10], a balanced account dated to AS 7 and concerning the merchant Ur-Dumuzida, provides an explicit indication that the wool:silver price ratio was set for accounting purposes by the administration. Three separate quantities of wool with an equivalent value in silver are entered there. Each displays a wool:silver price ratio of 10 minas of wool per shekel of silver. Two of these are substantial quantities (nine plus and ten plus talents respectively) of wool made available to the merchant in the usual manner to finance the acquisition of the commodities (spices, aromatics, bitumen and gypsum) listed in the credits of the account. The third quantity of wool was specifically supplied to trade for gold. Obv. (i) 7-10 read 5 gu₂ siki ku₃-sig₁₇ / ku₃-bi ½ ma-na / i₃-bi₂-za-bi 10 gin₂ / giri₃ lu₂-ᵈen-lil₂-la "5 talents (300 minas) of wool (for) gold[30], its silver ½ mina (30 shekels), its loss (of silver) 10 shekels via Lu-Enlila". Thus, fixing the value of the wool, exchanged for gold, at the same price ratio of 10 minas of wool for each shekel of silver leads to a shortfall (i₃-bi₂-za) of 10 shekels in the silver equivalent required to exchange for gold. Compensation for this loss is supplied via Lu-Enlila and the i₃-bi₂-za of 10 shekels of silver is added to the debits to produce the total of the sag-nig₂-gur₁₁-ra(k) at obv. (i) 13.

An explicit illustration that i₃-bi₂-za-bi arises from a shortfall or loss in the silver equivalent of the gold is provided by a parallel account of Pada, the merchant, and dated AS 7. This is provided by [YNER 08, 11] obv. (i) 15-17: [5] gu₂ siki ku₃-sig₁₇ / ku₃-bi ½ ma-na / [10 gin₂] ku₃ i₃-bi₂-za ku₃-sig₁₇ "[5] talents (300 minas) wool (for) gold, its silver ½ mina (30 shekels), [10 shekels] silver (is) the loss of the gold". The restorations of the numbers in these lines are entirely plausible in that the entry of wool with its silver equivalence at obv. (i) 5-6 is again a ratio of 10:1 and the silver equivalence of the wool for gold is also ½ mina as in [YNER 08, 10]. Further the two texts are dated but two months apart. Unfortunately, the total value of the items in the sag-nig₂-gur₁₁-ra(k) is destroyed and an authoritative check on the numbers cannot be made. More importantly, the relationship between the value of the wool and the gold is clear. Even more significantly, it is apparent that the wool:silver price ratio, and thus the value of the wool, is fixed independently of the value of the gold.

Table 6. siki(GI) expenditures in merchant accounts.				
Text Sigla	*Subscript*	*Indicative phrases*	*Provenance*	*≈mean ma-na siki(GI) per shekel silver*
[YNER 08, 06]	nig₂-ka₉-ak PN (dam-gar₃)	*n* gu₂ siki ku₃-bi *n* ma-na, ša₃-bi-ta, PN šu ba-ti, zi-ga-am₃, la₂-ia₃	Umma	9
[Fs Jones 216]	nig₂-ka₉-ak PN dam-gar₃	*n* gu₂ siki ku₃-bi *n* ma-na, ša₃-bi-ta, zi-ga-am₃, la₂-ia₃	Umma	10

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[30] See Ouyang (2013: 12 and notes 405 and 406) for siki ku₃-sig₁₇ "wool (to buy) gold" or siki sa₁₀-am₃ ku₃-sig₁₇ "wool as the price of gold".

Table 6. siki(GI) expenditures in merchant accounts.				
Text Sigla	Subscript	Indicative phrases	Provenance	≈mean ma-na siki(GI) per shekel silver
TCL 05, 6046	? i_3-šah$_2$ gur, i_3-sa$_{10}$-sa$_{10}$, sag-nig$_2$-gur$_{11}$-ra dam-gar$_3$-ne	n gu$_2$ siki ku$_3$-bi n ma-na, ša$_3$-bi-ta, zi-ga-am$_3$	Umma	9
YNER 08, 03	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	10
TCL 05, 6052	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki ku$_3$-bi n ma-na, ša$_3$-bi-ta, PN šu ba-ti, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	9
TCL 05, 6056	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	9
YNER 08, 04	nig$_2$-ka$_9$-ak PN (dam-gar$_3$)	n gu$_2$ siki (GI), ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	9
JRAS 1939, 32	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga bala-a, kišib$_3$ nu-ra-a, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	10
AAICAB 1/1, pl. 067-068, 1924-0667	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	9
STA 23	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	10
YNER 08, 09	nig$_2$-ka$_9$-ak PN (dam-gar$_3$)	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, [la$_2$-ia$_3$]	Umma	10
SNAT 365	nig$_2$-ka$_9$-ak PN (dam-gar$_3$)	n gu$_2$ siki (GI), ku$_3$-bi n ma-na, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	10
YNER 08, 10	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	10
STA 01	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	12
YNER 08, 11	nig$_2$-ka$_9$-ak PN (dam-gar$_3$)	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	10

Table 6. siki(GI) expenditures in merchant accounts.				
Text Sigla	Subscript	Indicative phrases	Provenance	≈mean ma-na siki(GI) per shekel silver
UMM 2275	nig$_2$-ka$_9$-ak PN (dam-gar$_3$)	n gu$_2$ siki (GI), ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	12
YOS 18, 123	nig$_2$-ka$_9$-ak nig$_2$-sa$_{10}$-ma, PN dam-gar$_3$	n gu$_2$ siki (GI), ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	12
TCL 05, 5680	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$, la$_2$-ia$_3$	Umma	12
YNER 08, 12	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gu$_2$ siki, ku$_3$-bi n ma-na, sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, kišib$_3$ PN, zi-ga-am$_3$	Umma	12
SNAT 504	nig$_2$-ka$_9$-ak PN dam-gar$_3$	n gin$_2$ ku$_3$-babbar, nig$_2$-ka$_9$ ku$_3$-ta, n gu$_2$ siki, ku$_3$-bi n gin$_2$, bala-še$_3$, zi-ga-am$_3$	Umma	13
TCL 05, 6037	nig$_2$-ka$_9$-ak dam-gar$_3$-ne, lu$_2$ -kal-la	sag-nig$_2$-gur$_{11}$-ra-kam, ša$_3$-bi-ta, n gu$_2$ siki, ku$_3$-bi n gin$_2$, nig$_2$-ka$_9$ siki-ka ugu$_2$-a ba-a-gar, zi-ga-am$_3$	Umma	10

Variation of wool:silver ratios in the merchant accounts

Figure 3 illustrates the distribution of the wool:silver ratio in the merchant accounts from Amar-Suen 3 to Šu-Suen 6. These are the only years with merchant accounts containing data with which to estimate these ratios. Twice as many observations of the ratio occur in the first three years than in the second ten years of the period. From AS 3 to AS 6 the mean value of the ratio is 9 ½ minas of wool per shekel of silver compared with a ratio of 10:1 throughout the whole period defined by the merchant accounts, while the std. dev. around the mean in the early part of the period is ± ½ mina. In these first three years, the ratio varies between 9 and 10 minas per shekel, whereas in the later 10 years the majority of values are 12:1. In these later years the mean ratio is approximately 12 minas ± 1 mina of wool per shekel of silver while the median is 12:1. The distribution in the merchant accounts mirrors that displayed in Figure 4 for the data retrieved from all texts, except that the complete set of observations of the wool:silver ratio are from texts emanating from more years within a longer period spanning from Šulgi 34 to Ibbi-Suen 2. These distributions and variations in the value of the ratio are discussed again below. In Figure 3 the vertical bars through each value of the ratio depict the area of the distribution which is within one standard deviation on either side of the mean value of approximately 10 minas per shekel. Until AS 8, the values of the wool:silver ratio lie within 1 std. dev. below the mean for the whole of the distribution. After AS 8 most values lie outside 1 std. dev. above the mean at around 12 minas per shekel. There are two outliers to this distribution, both of which occur within the year ŠS 6, one is equal to 13 minas per shekel and the other has an 8:1 ratio.

Figure 3.Wool:silver price ratio in merchant accounts

The wool:barley ratio

The introduction summarises the findings of the first part of this study (Cripps 2017), which presented evidence of the locus and likelihood in the economy of an administered barley:silver ratio of 300 litres (1 gur) of barley per shekel of silver and discussed the role of this bi-monetary ratio in the commodity money economy of the Ur III state. Assyriologists have held a variety of views as to whether barley and silver functioned in a similar manner in both the institutional sector and thus in its written accounts and in the "local" non-recorded sectors, or were predominantly exclusive to the two separate areas of the economy (Widell 2005:398-9). However, there is little doubt that both silver and barley were used as money in the accounted institutional sectors as indicated by many primary documents and summary accounts and arguably so in the undocumented non-institutional sector. Both silver and barley also functioned as mediums of equivalence applied to all goods (Dahl 2003:44-5).

Table 7 excerpts three Umma texts which document the equivalence between quantities of wool and capacity measures of barley expressed both as *n* ma-na siki / še-bi *n* (gur) and *n* še gur / siki-bi *n* ma-na. Each enables the calculation of a wool:barley price ratio which can obviously be related to our earlier estimations of barley:silver ratios. A column specifying the year dates of the wool transactions in each has been added to Table 7 so that their location in time can be related to the ratios plotted by year date in Figure 4. In fact, of four transactions only two can be dated.

UTI 5, 3497, a much-damaged tablet contains two surviving examples, although the text probably contained others now partly or wholly destroyed. Rev. (i) 5'-6' with 26 $^2/_3$ ma-na siki / še-bi 2 3(barig) 3(ban$_2$) (gur) has a wool:barley ratio of 10 minas of wool per gur of barley, while rev. (i) 9': 20 ma-na siki še-bi 1 1(barig) 4(ban$_2$) 5 sila$_3$ (gur) has a ratio of 15:1. The wool, together with other commodities such as silver, plucked sheep, goats, sheep and lambs excluded from the annual count (udu bar gal$_2$, sila$_4$ bar-gal$_2$) and therefore belonging to shepherds, restores to a temple the equivalent value of at least some of the barley which had been collected from it (še e$_2$-ta šu su-ba) probably as fodder for animals (see Stępień 1996:38-40 for fodder texts from Umma). The professions of those who replaced the barley (še su-ga) are defined at rev. (ii) 18' as shepherds (sipa-da), supervisors of plough teams (nu-banda$_3$ gu$_4$) and livestock fatteners (kurušda) of the temple of Šara indicate this interpretation. Stępień identifies both ^{d}šara$_2$-mu (obv. (ii) 9') and ur-nigar^{gar} (rev (ii) 22') as kurušda but also respectively as a shepherd (p.193) and as a cowherd (p.196) of the temple Šara. The extant remainder of

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the colophon (rev. (ii) 19'-20': kišib₃ še e₂-ta šu [su]-ba / ša₃ a-pi₄-sal₄^{ki} "sealed document of barley collected from the temple in Apisal" may have been followed by a year date and a seal which are destroyed. The sealed document is an account produced by the temple, the scribes of which determine the equivalent amounts of wool and other commodities required to replace barley supplied by the temple, probably from its granary, as animal feed.

The transaction dated to ŠS 7 in AAICAB 1/1, pl. 041, 1911-237a-b where barley, as well as silver, in lieu of wool was remitted to discharge accumulated arrears of wool was discussed earlier. The equivalence between wool and barley was indicated in this instance with the phrase *n* še gur, siki-bi *n* ma-na. The wool:barley ratio was 12 minas of wool per gur of barley.

Nisaba 24, 38, an Umma text from the second year of Ibbi-Suen's reign, is a balanced wool account concerning transactions by Gududu, the son of Dadaga the governor of Umma at that time, and who was probably his chief household administrator (šabra e₂ ensi₂) (Dahl 2007:105). From (ša₃-bi-ta) the sag-nig₂-gur₁₁-ra-kam (debits) of various wools (siki hi-a, siki, siki GI, and siki gukkal), wool was expended (zi-ga-am₃) on cultic offerings to several temples and for a standard of Gu'edina, on allotments of wool (siki-ba) for female workers (geme₂), gudu priests of the temple of Šara, and potters, woven textiles of the milling women, and other textiles of several different qualities. Of direct concern to this analysis are rev. (ii) 11'-13' which record 5 gu₂ 36 ma-na siki / še-bi 33 3(barig) gur / ugu₂ ka-guru₇ ba-a-gar "5 talents and 36 minas of wool, its barley 33 gur and 3(barig), debited to the account of the chief granary supervisor". Thus 3336 minas of wool is allocated to the granary supervisor in lieu of 33.6 gur of barley, a wool:barley price ratio of 10:1.

Table 7. siki (GI): barley price ratios					
Text Sigla	Subscript	Indicative phrases	Provenance	ma-na siki (GI) per gur barley	Date
UTI 5, 3497	še su-ga sipa-[da] nu-banda₃-gu₄ u₃ kurušda [^{d}šara₂!?-ka?], kišib₃ še e₂-ta šu [su]-ba	*n* ma-na siki, še-bi *n* (gur)	Umma	10	Undated
UTI 5, 3497	še su-ga sipa-[da] nu-banda₃-gu₄ u₃ kurušda [^{d}šara₂!?-ka?], kišib₃ še e₂-ta šu [su]-ba	*n* ma-na siki, še-bi *n* (gur)	Umma	15	Undated
AAICAB 1/1, pl. 041, 1911-237a-b	nig₂-ka₉-ak si-i₃-tum, PN1. (envelope) (seal).	*n* še gur, siki-bi *n* ma-na	Umma	12	ŠS 7
Nisaba 24, 38	nig₂-ka₉-ak siki, gu-du-du	šu-nigin₂ *n* gu₂ siki hi-a, sag-nig₂-gur₁₁-ra-kam, ša₃-bi-ta, *n* gu₂ siki, še-bi *n* gur, ugu₂ ka-guru₇ ba-a-gar, *n* gu₂ siki hi-a, zi-ga-am₃, [la₂]- ia₃ *n* gu₂ siki gur,	Umma	10	IS 2

The wool:barley ratios in the three texts excerpted in Table 7 exemplify the bi-monetary equivalence of a shekel of silver and a gur of barley. The average value of the wool:silver ratio was shown to be 10 minas of wool (siki (GI)) per shekel of silver albeit with a probability that the average of the ratio may have changed to 12 minas per shekel from AS 8 onwards (see Figure 4). Two of the four examples from Table 7 have ratios of 10 minas of wool per gur of barley, one dated to ŠS 7 is 12:1 while the fourth is 15:1. Obviously, in these cases the value of the gur of barley would be equal to a shekel of silver.

More on the variation in the wool:silver price ratio
Figure 4 illustrates the distribution of the wool:silver ratio throughout the period from Šulgi 34 to Ibbi-Suen 2. The 58 observations of the ratio with Ur III year dates, listed in the Appendix, are plotted in the diagram. Three undated examples are omitted. It is immediately apparent that both the series illustrated in Figure 4 and indeed the more limited one in Figure 3 are unsatisfactory as time series. In a more appropriate series, the Year Date axis would be divisible into regular intervals and there should be one observation of the data for each time interval. Although, in Figure 4, there are 58 observations of the ratio (*y-axis*), there are only 21 separate years represented out of the 34 years of the entire period (*x-axis*) and the number of observations per year date varies between 1 and 8. The variations in the ratio frequently occur within the same year as well as sometimes in the same text. These inadequacies delimit the scope of the statistical analysis possible and to some extent the inferences which may be made with regard to variations in the wool:silver price ratio over time.

The vertical bars assigned to each observation in Figure 4 locate it in relation to one standard deviation on either side of the series mean of 10 ma-na siki (GI) per shekel of silver. Most of the distribution between Š 35 and AS 8 lies at the mean of 10:1 or within one standard deviation below the mean at 9:1. After AS 8 most the observations lie outside one standard deviation above the mean at 12 ma-na siki (GI) per shekel of silver. The mean of the series to AS 8 is 9.5:1; after AS 8 it is 12:1. Accordingly, it is possible to infer that there may have been a fall in the relative price or value of wool relative to silver of a little more than 20% around the end of Amar-Suen's reign and that this lower value may have persisted at least into the second year of Ibbi-Suen's reign.

Aside from the rather few outliers to the distribution of the ratio, Figure 4 suggests relative stability in the value of wool relative to silver sufficient to justify the assumption that it was fixed by the Umma administration at a standard price ratio of 10 minas of wool per shekel of silver to some point in AS 8 and thereafter at 12 minas per shekel. Throughout the period to AS 8, about 20 years, the ratio does, however, vary consistently by 1 mina per shekel, from 9 to 10 minas per shekel, a variation which hardly suggests the working of a market. Variations could be due to an inability to distinguish with precision from the texts between wool qualities or even siki and siki (GI). Are they really the same? After AS 8, about 12 years, the wool:silver ratio is predominantly 12:1, although there are significantly wider oscillations in the values of the ratio in Šu-Suen 6 and Ibbi-Suen 2.

Substantial institutional changes may account for the marked increase in the wool:silver price ratio from 10:1 in AS 7 to 12:1 in AS 8. We noted earlier the evidence that the province's flocks of sheep were managed by the temples, especially that of the god Šara, on behalf of the governor (ensi₂) of Umma, the *de facto* owner of the sheep and their products. When the ensi₂ changed, the province's flocks were transferred to the ownership of his successor (see [YOS 04, 237](#)). In AS 8, Amar-Suen may have died and coincident with the king's death, Ur-Lisi who had governed as the ensi₂ of Umma since Šulgi 33 fell from power (Dahl 2007:61). Šu-Suen succeeded his brother as King of Ur and Ayakalla was followed by his brother as governor of Umma late in AS 8. It is quite feasible therefore that these changes in the governance of the state and province led to an administrative revaluation of the relative price of wool. An attempt at an explanation of what motivated such

a devaluation would be highly speculative, since its apparent persistence after AS 8 suggests there may have been an enduring shift in the supply conditions of either wool or silver. Nonetheless, given the relative stability of the wool:silver ratios over long periods of time, any devaluation may well have resulted from a policy decision of government.

Figure 4. Wool (siki (GI)):silver price ratio

By ŠS 6, the Ur III state was beginning to experience some disruption. The Muriq-Tidnim had been built to stem the Amorite incursions and in Umma in ŠS 7, Ayakala was replaced by his brother Dadaga as governor and as we saw in YOS 04, 237, took ownership of the province's flocks. Within three years, Ibbi-Suen followed Šu-Suen as King of an ever-contracting Ur III state due to invasions of Amorites, Gutians, and Elamites and the break-away of core provinces (Liverani 2014:173). The wider oscillations in the wool:silver price ratio in this period, if real, may reflect increasingly unstable state and provincial administrations.

Summary and conclusions

The influence of context on the values of wool: silver price ratios is much more limited than in the case of the barley:silver ratios. We cannot point to differences arising from different geographical provenances of the texts. All but four of the 48 texts containing siki (GI): silver ratios are from Umma. Only two are from Girsu, one is from Puzriš-Dagan and another is from Nippur. Additionally, there are thirteen texts with siki kur-ra: silver ratios, three of which also contain a siki (GI): silver ratio, so that there are 58 different texts in all, which contain data relevant to this study. All the siki kur-ra texts also have a provenance of Umma. For all intents and purposes, therefore, the results of this study only refer to the wool economy in Umma and can only be translated to the entire economy of the Ur III state with care and some scepticism.

The useable barley:silver ratios were largely from texts from two provenances, Girsu and Umma, with more from the former than the latter, and variations in the ratio were accentuated by the different functions performed by the texts coincident with this geography. Most of the texts containing data on the siki (GI):silver ratio emanate from Umma and while 44% or 21 of them are to be found in a single genre, the merchant accounts, documenting the trading of wool surpluses produced by the governor's flocks of sheep, the other 56% (27) divide among texts with various purposes.

Eleven of the 27 texts are characterised by the syntax *n* gin$_2$ ku$_3$(-babbar) / siki-bi *n* gu$_2$(ma-na) and describe payments of silver to replace arrears of wool owed to the governing institutions of Umma. siki-bi defines the equivalent quantity of wool for which the silver is substituted, although the relative value of silver implicitly functions as the unit of account in these texts. Four of these are balanced accounts -*Sammelurkunde*- concerning members of the governing institutions. Three are balanced wool accounts which describe the assignment of resources of wool for a variety of purposes but also credit payments of silver to replace arrears of wool. These silver payments are made by shepherds, or on their behalf by livestock administrators, probably to cover shortfalls in wool quotas required by the administration. The fourth account is a payment of silver in lieu of wool which is one of the payments made to redeem arrears of wool accumulated over several years by an official of the provincial administration. The seven remaining texts with this syntax are *primary* records of the payment of silver in lieu of wool to the administration for such items as "field/irrigation" taxes and arrears in wool quotas required by the governing institutions.

With few exceptions, in those texts categorized by the alternative syntax *n* gu$_2$(ma-na) siki (GI) / ku$_3$-bi *n* gin$_2$), the value of the silver, ku$_3$-bi, operates as a unit of account. There are perhaps, a couple of examples in primary records formulated as receipts of wool, where wool may have been exchanged for silver, since it is possible to interpret them to mean that the wool was received but the silver was not delivered. In all other instances including primary records, 'ku$_3$-bi' is an accounting device to enable a quantity of wool to be converted to a silver value to facilitate the addition and comparison of the values of a range of different commodities in summary accounts. The merchant accounts provide the most obvious examples of such summary accounts, but there are examples included here of other kinds of summary account.

It is apparent from Figure 4 that variations in the wool (siki (GI)): silver price ratio do not result from these differing textual contexts. Irrespective of the context or function of the text, for a period of some 20 years to about the 7th month of AS 8, the value of the ratio varied between 9 and 10 minas per shekel of silver. From AS 8 to IS 2, (12 years) there was little variation of the ratio around a value of 12 minas wool per shekel of silver. The uneven time intervals in the data over these years require that we interpret it with some circumspection. Nevertheless, the fall in the value of siki (GI) relative to silver seems to persist for a decade or more. Joint changes to state and province governance offer plausible explanations for the devaluation. The data from the merchant texts, displayed in Figure 3, is clearly a co-distributed subset of the full data and does not alter the pattern illustrated in Figure 4.

There is relatively more variation in the siki kur-ra: silver ratio in some thirteen observations from the first three years of Šu-Suen's reign. The ratio varies from 6 minas per shekel to 10 minas per shekel with a mean ratio of 8.5:1 and a median value of 8:1. Given the dates of these data, it is more appropriate to compare their values with an average of 12:1 than the "standard" of 10:1 so that it would appear that on average siki kur-ra may have been considered some 33% more valuable than siki (GI), which is not readily verifiable from transactions of the two kinds of wool recorded side-by-side in a single text. In such instances their respective wool:silver ratios were often the same, usually at 10:1. Nevertheless, the average difference between the price ratios of siki kur-ra and siki (GI) though available from a relatively few observations, does seem to testify to a quality distinction between the two kinds of wool. Variations in the value of wool used to produce textiles of different qualities, on the other hand, are not so apparent in the data.

Lastly, a few texts containing data on a wool:barley price ratio corroborate both the bi-monetary role of silver and barley and the equivalence between the gur of barley and the shekel of silver to measure value. In addition, the limited variation and shifts in the siki (GI): silver relative price over a period, as with the barley:silver ratio, suggest administrative fixing of its value. However, despite apparent evidence from the texts of the relative

price of wool and that this may have been fixed at a "standard" of approximately 10 minas of wool per shekel of silver or per gur of barley, it remains to be understood on what basis it was determined that a gur of barley was equivalent in value to 10 minas of wool.

Appendix

<div align="center">

Ur III siki (GI):silver price ratios in Year Date order

</div>

Text ID	Unit	Ratio (minas per shekel)	Account Type
Š 34 (Umma) TCL 05, 6171*	ku_3-bi	8	*Table 5. Miscellaneous expenditures/deliveries of siki (GI) with silver equivalents*
Š 35 (Umma) UTI 6, 3778	ku_3-bi	8	*Table 4. Payments / Receipts of siki(GI) with silver equivalents*
Š 37 (Umma) BIN 05, 149*	siki-bi	10	*Table 3. Payments of silver in lieu of siki(GI)*
Š 38 (Girsu) Nisaba 07, 36*	ma-na-ta	10	*Table 5. Miscellaneous expenditures/deliveries of siki (GI) with silver equivalents*
Š 38 (Umma) BPOA 7, 2279	ku_3-bi	9	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
Š 38 (Umma) Salesianum 4, 174 01*	ku_3-bi	9	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
Š 41 (Umma) JCS 54, 10, 68	siki-bi	10	*Table 3. Payments of silver in lieu of siki (GI)*
Š 44 (Girsu) SNAT 028	ku_3-bi	10	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
Š 44 (Umma) Nik 2, 390	[ku_3]-bi	9	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
Š 46 (Puzriš-Dagan) Aleppo 482	ku_3-bi	10	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
Š 48 (Girsu) CT 07, pl. 46, BM 017772*	ku_3-bi	10	*Table 5. Miscellaneous expenditures/deliveries of siki (GI) with silver equivalents*
Š 48 (Umma) AnOr 01, 070	siki-bi	10	*Table 3. Payments of silver in lieu of siki (GI)*
Š 48 (Umma) BPOA 1, 1776	siki-bi	10	*Table 3. Payments of silver in lieu of siki (GI)*
AS 1 (Umma) SANTAG 6, 107	siki-bi	10	*Table 3. Payments of silver in lieu of siki (GI)*
AS 3 (Umma) Fs Jones 216*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 3 (Umma) Fs Jones 216*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 3 (Umma) AAICAB 1/1, pl. 065-066, 1924-0666	ku_3-bi	10	*Table 2. nig$_2$-ka$_9$-ak (siki) with silver paid in lieu of siki (GI)*
AS 3 (Umma) AAICAB 1/1, pl. 065-066, 1924-0666	ku_3-bi	10	*Table 2. nig$_2$-ka$_9$-ak (siki) with silver paid in lieu of siki (GI)*
AS 4 (Umma) TCL 05, 6046*	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 4 (Umma) VDI 1976/3, 110-111	ku_3-bi	10	*Table 5. Miscellaneous expenditures/deliveries of siki (GI) with silver equivalents*
AS 4 (Umma) YNER 08, 03*	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 4 (Umma) YNER 08, 03*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) TCL 05, 6052*	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) TCL 05, 6056*	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) YNER 08, 04*	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) YNER 08, 06	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) JRAS 1939, 32*	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) JRAS 1939, 32*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) AAICAB 1/1, pl. 067-068, 1924-0667*	ku_3.bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 5 (Umma) AAICAB 1/1, pl. 067-068, 1924-0667*	ku_3.bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 6 (Umma) STA 23*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 6 (Umma) STA 23*	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 6 (Umma) YNER 08, 09*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 6 (Umma) SNAT 365	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 6 (Umma) SNAT 365	ku_3-bi	9	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 7 (Umma) YNER 08, 10*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 7(Umma) YNER 08, 10*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 7(Umma) YNER 08, 10*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 7 (Umma) YNER 08, 11*	ku_3-bi	10	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 8(Umma) STA 01*	ku_3-bi	12	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 9 (Umma) UMM 2275*	ku_3-bi	12	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 9 (Umma) YOS 18, 123	ku_3-bi	12	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 9 (Umma) YOS 18, 123	ku_3-bi	12	*Table 6. siki (GI) expenditures in merchant accounts©*
AS 9 (Umma) YOS 18, 123	ku_3-bi	12	*Table 6. siki (GI) expenditures in merchant accounts©*
ŠS 1 (Umma) MCS 8, 93, BM 105390*	siki-bi	12	*Table 2. nig$_2$-ka$_9$-ak (siki) with silver paid in lieu of siki (GI)*
ŠS 1 (Umma) AUCT 3, 313	ku_3-bi	10	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
ŠS 1 (Umma) AUCT 3, 251	ku_3-bi	10	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
ŠS 2 (Umma) TCL 05, 5680	ku_3-bi	12	*Table 6. siki (GI) expenditures in merchant accounts©*
ŠS 2 (Umma) AUCT 1, 444	ku_3-bi	12	*Table 5. Miscellaneous expenditures/deliveries of siki (GI) with silver equivalents*
ŠS 3 (Umma) SANTAG 6, 269	siki-bi	12	*Table 2. nig$_2$-ka$_9$-ak (siki) with silver paid in lieu of siki (GI))*
ŠS 3 (Umma) CST 595*	ku_3-bi	10	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
ŠS 5 (Umma) YNER 08, 12*	ku_3-bi	12	*Table 6. siki (GI) expenditures in merchant accounts©*
ŠS 6 (Umma) SNAT 504	ku_3-bi	13	*Table 6. siki (GI) expenditures in merchant accounts (P)*

ŠS 6 (Umma) TCL 05, 6037*	ku₃-bi	8	*Table 6. siki (GI) expenditures in merchant accounts (P)*
ŠS 6 (Umma) TCL 05, 6037*	ku₃-bi	12	*Table 6. siki (GI) expenditures in merchant accounts (P)*
IS 2 (Umma) AAICAB 1/1, pl. 041, 1911-237a-b*	siki-bi	12	*Table 2. nig₂-ka₉-ak (siki) with silver paid in lieu of siki (GI)*
IS 2 (Umma) AAICAB 1/1, pl. 041, 1911-237a-b*	siki-bi	12	*Table 2. nig₂-ka₉-ak (siki) with silver paid in lieu of siki (GI))*
IS 2 (Nippur) NATN 002	siki-bi	15	*Table 3. Payments of silver in lieu of siki (GI)*
Undated (Umma) SANTAG 6, 381	ku₃-bi	9	*Table 5. Miscellaneous expenditures/deliveries of siki (GI) with silver equivalents*
Undated (Umma) Nisaba 15, 1120	ku₃-bi	8	*Table 4. Payments / Receipts of siki (GI) with silver equivalents*
Undated (Umma) CHEU 051*	siki-bi	10	*Table 3. Payments of silver in lieu of siki (GI)*
Mean		10	
Std. dev.		1.4	
Median		10	
Mode		10	

All ratios except std. dev. have been rounded to nearest ma-na siki (GI) per shekel of silver.

* denotes texts also present in Snell's table 6.

© merchant text with ratio data in sag-nig₂-gur₁₁-ra(k) "debits".

(P) merchant text with ratio data in ša₃-bi-ta……. zi-ga-am₃ "credits".

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