Exogenous shocks and Babylonian commodity prices

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1. Introduction

One main objective of the project "On the efficiency of markets for agricultural products in pre-industrial societies: The case of Babylonia c. 400-c. 60 BC" was to provide a discussion of the price data contained in the Astronomical Diaries and the Commodity Price Lists in view of the historical events of the period.[1] After all, if these prices are indeed market prices – as has been established with reasonable certainty[2] – then various types of exogenous shocks ranging from events pertaining to the field of political history such as episodes of warfare to natural disasters, for example locust invasions, can be expected to have repercussions in the data.[3] In this paper, two different yet related research strategies for the historical analysis of the Babylonian price series shall be presented.

In the first part, the price trends of the second half of Seleucid reign over Babylonia, from the troubled accession to the throne of Antiochus III (222 BC) to the Parthian conquest of Babylonia (early summer 141 BC) shall take centre stage. The data of this period are still relatively unexplored by modern research but show some very interesting fluctuations, for example, the lowest prices on record for all commodities fall precisely in these years (November 188 BC for barley and August 166 BC for dates[4]). The focus in this section shall be on outliers, thus suspiciously high or low prices, and their possible correlation to historical events which may be considered as the proximate cause of these anomalous prices.[5] The basic idea behind this approach is fairly simple: individual events can be expected to have an impact either on the supply or on the demand situation of the individual commodities and thus

[1] The Astronomical Diaries (henceforth ADs) containing price data have been published by Hunger/Sachs 1988, 1989, an 1996 (the *sigla* conventionally employed for these volumes are ADART I, II, and III). For a useful introduction to these texts see e.g. van der Spek 1993. The Commodity Price Lists were edited by Slotsky/Wallenfels 2009 (see also the review Pirngruber 2011 for *errata* in this book).

[2] Van der Spek 2000, 295-297, Temin 2002.

[3] An analysis of the impact of warfare on prices in Babylonia was provided by Van der Spek 2000 by means of brief case studies, e.g. of the so-called Wars of the Successors in the aftermath of Alexander the Great's premature death (which left his empire without a suitable heir) in the last quarter of the 4th century BC. The impact of locust invasions has been discussed in Pirngruber, *forthcoming*.

[4] The reading of 672 liters of dates for one shekel of silver is questionable; if incorrect, dates would peak with barley in November 188 BC.

[5] This of course excludes events such as the performance of sacrifices 'for the life of the king' in the Esangila-temple so frequently reported in the historical sections of the ADs especially in the first half of the 2nd century BC. It is most unlikely that the sacrifice of small quantities of oxen and sheep caused a price increase in the commodities recorded in the ADs. For a general discussion of these sacrifices see Pirngruber 2010.

affect prices. Also, changes in the price level can come about by a decrease or an increase in the amount of money in circulation which in antiquity was highly susceptible to the vicissitudes of history, too. Such an investigation – if indeed providing us with solid instances of correlation between outliers in the price data and different kinds of exogenous shocks – is a straightforward way to make a case for the price-determining force of historical events.

In a second step, such a somewhat 'impressionistic' chronological price analysis shall give way to a topical investigation. One particular category of exogenous shocks identified in the first part – monetary shocks – shall receive more ample treatment. Instances of this type of event throughout the time span of the dataset shall be identified and discussed. As the concept of a *category* of historical events employed is based on an interpretative reading of historical events, it is of course necessary to elucidate briefly by what reasoning (other than the mere availability of historical information) the particular category of monetary shocks was compiled and which events were included therein. Although not entirely unproblematic, this approach has the advantage to it that it will ultimately allow for a formal testing of the hypothesis suggested (the impact in form of a regression analysis employing dummy variables.

2. A price history of the Later Seleucid period from Antiochus III to the Parthian conquest, ca. 225-140 BC

The source material for the second half of Seleucid reign over Babylonia is distributed very unevenly. Whereas the reign of Seleucus IV (187-175 BC) is virtually undocumented, the documentation of the reigns of Antiochus III (223-187 BC) and IV (175-164 BC) is abundant enough to have provided modern scholarship with data for detailed biographies.[6] An important source for the fortunes of the empire in the West is the Greek historian Polybius, whose focus is naturally on the interaction of the Seleucids with the ever-growing Roman empire. The conflicts of Antiochus III with Rome culminating in the Syrian War (192-188 BC) and the severe defeat of the Seleucid king at Magnesia brought about substantial losses for the empire with the treaty of Apameia. Not only were the Seleucids forced to renounce to all of Asia Minor west of the Taurus mountain range, but also the size of the army was

[6] The biographies are Schmitt 1964 (on Antiochus III) and Mittag 2006 (on Antiochus IV). For a general history of the Hellenistic world with an excellent overview of the sources see still Will 1979/82. A general overview and synthetic discussion of the sources on Seleucid history kings after Antiochus IV is now provided by Ehling 2008.

severely restricted. Additionally, a huge war indemnity of 15,000 talents of silver was imposed upon them. This war indemnity is traditionally assumed to have been a severe blow to the empire and if not caused then at least accelerated its decline.[7] This claim will be kept in mind in our investigation of commodity prices in Babylon, one of the core provinces of the Seleucid empire in terms of population size, level of urbanization and agricultural productivity.[8] The downfall of the empire, however, also had more narrowly political reasons. The relationship between the Roman and Seleucid empires remained strained also after the peace of Apameia was concluded. Exemplary is the story of the 'day of Eleusis' when Antiochus IV after his conquest of Egypt was forced to retreat under the threat of war by the Roman legate C. Popilius Laenas in 169 BC.[9] Although the Seleucid empire was thus at times powerful enough to intervene with force in neighboring Egypt, it was also continuously afflicted by domestic troubles. The most prominent example is the insurrections in Judea under the Maccabees lasting for several decades. [10] Another important factor in the decline of the Seleucid empire is to be sought the internecine conflicts for the throne between the different branches of the dynasty, notably between those who descended form Seleucus IV (Demetrius I and II) and those who descended, or professed to descend, from his brother and successor Antiochus IV (Antiochus V and Alexander Balas).[11]

The Eastern provinces including Babylonia on the other hand are largely absent from the Classical Sources. One of the few exceptions is the revolt of the Median satrap Molon, who in the early days of Antiochus III (222-220 BC) defected from central authority and for a short period was able to assert himself also in parts of Babylonia.[12] Of other episodes, such as the *anabasis* of Antiochus III into the Upper Satrapies (212-205 BC) hardly more than the fact that they happened is known.[13] Additionally, there are some historiographic cuneiform

[7] The *locus classicus* is Will 1979/82, 238-240, pointing out the combined effect of the indemnity itself and the loss of revenues from Asia Minor. In a similar vain, it was recently stated that after Apameia "Antiochus was in constant need of money" (Boiy 2004 156). Aperghis 2004 in his attempt of a quantification of the expenditure of the Seleucid state (esp. 259-260) likewise come to the conclusion of Apameia causing significant "cash flow problems" (260) for the Seleucid empire.
[8] Aperghis 2004, 36-40 and 56-58 on population and urbanization, and 60-63 on productivity.
[9] Narrated by Polybius XXIX 27.1-8, see also Mittag 2006, 214-224.
[10] Mittag 2006, 225-281, with previous literature.
[11] Ehling 2008, 279-284 attributes highest importance to these struggles, playing down other factors (especially the impact of Roman foreign policy), which results in a somewhat unbalanced account. For an interesting approach to the Mediterranean East in later 3rd/early 2nd century BC informed by political theory see now Eckstein 2008.
[12] Will 1979/81 II, 17-23, Schmitt 1964, 116-148.
[13] This undertaking and its few sources are analyzed by Sherwin-White/Kuhrt 1993, 197-200. Antiochus' main aim seems to have been the reassertion of Seleucid suzerainty over the Eastern provinces, which had grown weaker in the previous decades.

sources recording otherwise scarcely documented events. A most intriguing document of this period is the Babylonian chronicle BCHP 14 referring to the settlement of Greek colonists under a king Antiochus (III or IV).[14] From the considerable number of Astronomical Diaries, AD -168A containing a brief reference to Antiochus' IV invasion of Egypt deserves special mention. AD -149A relates the victory of Alexander Balas over Demetrius near Antioch-on-the-Orontes, this event is also narrated by Flavius Josephus in his *Antiquitates Judaicae* (13 58-61).[15] Frequently appearing subjects in Diaries and chronicles of that period are judicial proceedings (e.g. AD -161A, BCHP 17) and cultic and religious matters, especially the performance of sacrifices to Bēl, Bēltiya and the 'Great Gods' in the Esangila-temple. AD -204A reports the participation of Antiochus III in the Babylonian New Year's Festival upon return form his *anabasis*. There are also several references to internal strife and also ethnic tensions between Greeks and natives in Babylonia (AD -162). Especially the period August-November 145 BC is densely documented due to the extensive historical sections of AD -144 (covering months VI-VIII), conveying an interesting glimpse into the troubled state of affairs in Babylonia in the years before the Parthian conquest.

Babylonia remained a province of the Seleucid empire until spring/early summer 141 BC only, when it was conquered by the Parthians under Mithridates I. The Astronomical Diary -140A from year 170 of the Seleucid Era (141/140 BC) already dates according to a king Arsaces (^{I}*Ar-šá-kám* LUGAL), the Parthian throne name which was adopted by all kings. The Parthian takeover must have taken place at some point after April 141 (the Diary AD-141F of the second half of the preceding year recording events between September 142 and April 141 BC is still dated to Demetrius II) but before June/July 141 BC in which month the highest echelons of the provincial administration seem to have been re-organized according to the agenda of the new king, who was staying at this time in Seleucia-on-the-Tigris (AD-140A, lines 3-9). Occasional attempts of Seleucid kings at re-conquest of the province did not meet lasting success, and after the failure of Antiochus VII (130 BC), Babylonia was to remain Parthian for the centuries to come.[16]

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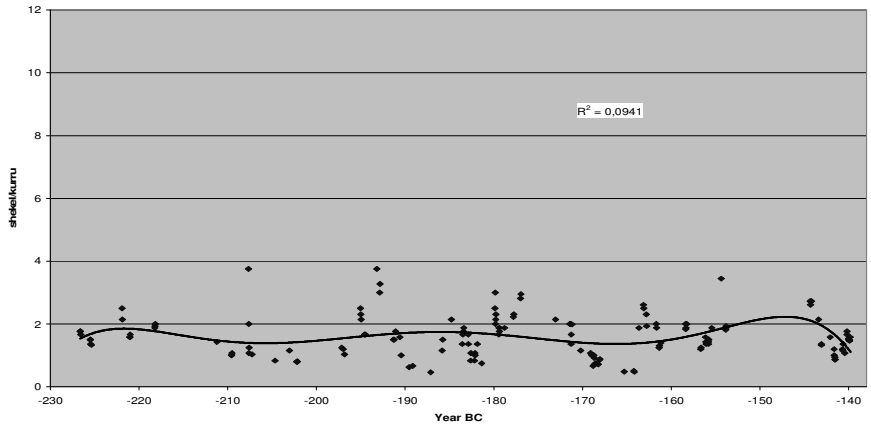
[14] This chronicle is so far published only on-line at http://www.livius.org/babylonia.html. The date of the settlement of Greek colonists in Babylon was attributed to one of these kings already before this document came to light. Van der Spek 1986, 71-78 *et passim* argues for a date under Antiochus IV, however, a date during the reign of Antiochus III was suggested by Boiy 2004, 208. This latter interpretation gives rise to a tentative explanation of the diverging price developments of barley and dates, see below.

[15] We follow here the interpretation of Van der Spek 1997/98, 168-169. See also the alternative interpretation of Del Monte 1997, 91-94 who locates these events in the region of the Persian Gulf.

[16] See Wiesehöfer 1994, 163-202 for an introduction to the Parthian empire. The contributions in Wiesehöfer 1998 provide an excellent survey of the source documentation of this empire.

Contrary to what one might expect in the light of scholarship declaring the treaty of Apameia a turning point in Seleucid history (see above), the prices in Babylonia until the Parthian takeover were substantially lower for all commodities than during the first half of Seleucid reign. Barley, for example, cost on average 1.59 shekel/*kurru*, compared to the mean value of the preceding period amounting to 2.57 shekel/*kurru*. It must be emphasized at this point that a difference of almost one shekel per *kurru* is indeed a noteworthy fluctuation: the scarce data at our disposal points to a monthly wage level for an unskilled worker between one and four shekel per month.[17] In the same period also the level of volatility as measured by the CV decreased from 0.63 to 0.41. In fact, there is not a single high price exceeding the four shekel/*kurru* throughout the period between ca. 225 and 140 BC, whereas in the first 75 years of the 3rd century BC the prices on several occasions rose to a level between 4 and 6 shekels/*kurru*, and even above. The extraordinary high equivalents for barley of October/November 188 BC (390 liters/shekel) and August to October 168 BC (372 and 378.5 liters/shekel in months V and VII respectively), on the other hand, appear less exceptional when expressed as *prices*: the all-time high equivalent of 390 liters/shekel corresponds to 0.46 shekel/*kurru*. This is still one shekel below the mean price of the period, but prices quite frequently rise to a level of one or also more shekels above average level.

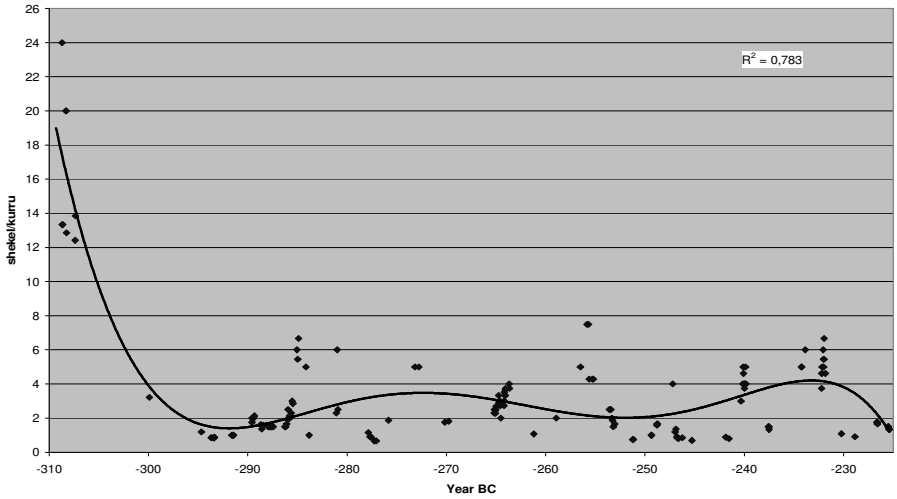


1. Barley prices in the Late Seleucid period, ca.225-140 BC

In addition to the lower fluctuation in the data and the lower average price level, a third phenomenon which becomes evident from the graph 1 above is the very low coefficient of determination (r^2) amounting to only 0.09. The trend-line in general moves slightly below

[17] The pertinent sources are briefly discussed in Van der Spek 2006, 291-293.

the 2 shekel/*kurru* mark, with small oscillations only. In the period ca. 300-225 BC on the other hand the barley price oscillates considerably between below 2 and above 4 shekel/*kurru*. As the data of that earlier period, however, is characterized by distinct periods of peaks and troughs, the trend-line follows the available prices more closely.



2. Barley prices in the Early Seleucid period, ca. 300 -225 BC

The conclusion is that in the later Seleucid period hardly any distinct trends are discernible in the data. Prices fluctuate more at random but within a rather narrow margin, coherent periods of higher or lower prices do not occur with the frequency and intensity of the period between ca. 300 and 225 BC. This is not to say that political events do not have repercussions in the price data. However, their effects seem to last for briefer moments only, with prices returning much quicker to their base level compared to the preceding period. A good case in point is the mid-140s BC. In September/October 145 BC, the barley price rose to 2.73 shekel/*kurru*, for the same period, AD -144 testifies to the (bellicose?) activities of a certain Aria'bu, the presence of various diseases in the country, as well as preparations made to ward off the impending invasion by the Elamite king Kamnaškiri, which finally did happen later the same year (but unfortunately, no prices from this later episode are extant).[18] However, already in the winter of the following year, prices are back to a very low level of about 1.35 shekel/*kurru* (November/December 143 BC). Both cress and sesame show a similar pattern of a brief peak soon followed by relaxation, whereas dates and *kasû* remained unaffected by this crisis.[19]

[18] See also Del Monte 1997, 98-100 on the tenacious conflicts between Babylonia and Elam in this period.
[19] For a brief introduction to the basic commodities of the ADs see Slotsky 1997, xx.

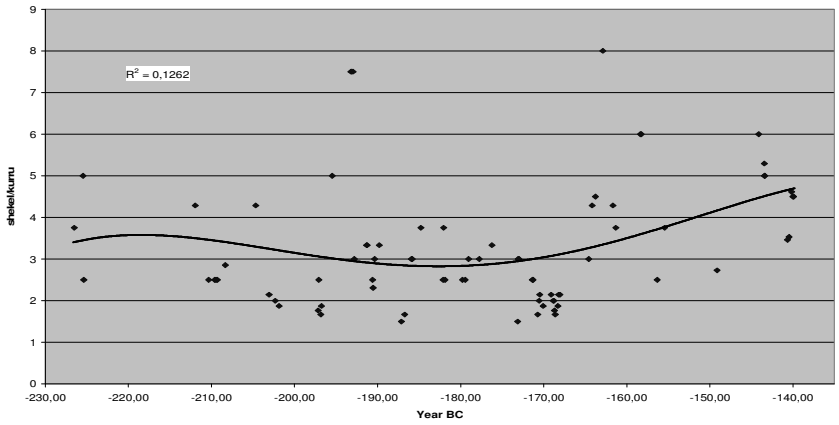
The largest outlier in the barley price material of the later Seleucid period dates to April 208 BC when the barley price rose to 3.75/shekel/*kurru*. However, already in the following month, the price dropped first to 2 and then even to 1.07 shekel/*kurru*. In the light of the precise date of this price (spring) the best explanation for this outlier is a supply crisis in the period immediately preceding the harvest. Once new barley arrived at the market, the price even dropped to a level even below average.[20] It is remarkable that the largest outlier in the price data was caused by simple seasonal fluctuation rather than by an exogenous shock. The staple food market in late Seleucid Babylonia seems to have been unusually stable for a pre-industrial economy.[21]

The very high barley price of 3.44 shekel/*kurru* of August 155 BC has to remain unexplained in absence of historical information. However, note that still within the same harvest year the price dropped contrary to the usual pattern of seasonal fluctuation to a level of about 1.9 shekel/*kurru* in the immediate pre-harvest period in February 154 BC. This was still above the long-term average of the barley price in the later Seleucid period, but has the important consequence that a harvest failure can be excluded as decisive factor driving up the barley price in that year. Interestingly, the date price (2 shekel/*kurru*) was very much above its long-term average of 0.82 shekel/*kurru* in February 154 BC, but there are alas no other attestations from the year 155/4 BC. The historical section of AD -154A containing the high barley price also mentions a general, but the precise context is unclear as the passage is badly broken. Some kind of local strife in Babylonia is not an unlikely explanation for this price pattern, but cannot be proven. In such a scenario, the market was most severely disrupted in summer 154 BC causing at least the barley price – prices of other commodities are not extant in that month – to soar. However, still within the same harvest year the barley price recovered to some extent. Whatever was happening during that summer seems also to have put a strain on the date supply, as is reflected in the above average price level of this commodity in winter 154/3 BC.

The second time that barley arrived at the 3.75 shekel/*kurru* mark during the period under discussion, in October 194 BC, also an above average price of dates (1.88 shekel/*kurru*)

[20] See also Van der Spek/Mandemakers 2003, 527 on this sequence of prices.
[21] The main reason for this phenomenon seems to reside in the fact that Babylon was a dual-crop society, a factor which considerably stabilizes prices *inter alia* by smoothening out seasonal fluctuation, see Földvári *et al*., forthcoming.

is recorded. Similarly, in this same autumn of 194 BC cress stood at 7.5 shekel/*kurru* and thus more than twice its mean price, and also sesame (10.91 shekel/*kurru*) was significantly above its average price of 6.9 shekel/*kurru*. As also *kasû* and wool were to a minor extent above their average price, a general price rise affecting all commodities seems to have taken place, but as opposed to earlier instances such as during the 230s BC,[22] there is no clear information about domestic revolts in Babylonia.



3. Cress prices in the later Seleucid period, ca.225-140 BC

The focus of the Greek sources is again on the westernmost provinces of the empire. During those years, Antiochus III dedicated himself to large-scale military operations in Asia Minor and even Thrace, which were brought to a successful ending in 192 BC.[23] Afterwards he remained in the West, where his meddling in Greek affairs ultimately aroused the suspicions of the Romans and brought about the Syrian War (192-188 BC) which ended in utter defeat for the Seleucids. The ADs provide hardly any information for the 190s BC: we know of a lightning stroke (*miqitti išâti*) in January 197 BC and of the presence of the highest military commander of the satrapy in October 194 BC – incidentally the month for which the peak prices are attested. With an eye on the general political situation one might hypothesize a conscription of army troops in Babylon, which were to be sent to the imperial army in Asia Minor. In such an approach, the universal price increase is explained by the boost in demand caused by the presence of soldiers. This approach has much to commend to it, for example the quick recovery of the cress price which was already with the next price attestation at five months distance (in March 193 BC) back to an average level (see below). Also barley and

[22] These years have been briefly discussed in van der Spek 2006, 299-301.
[23] Schmitt 1964, 262-295, and Ma 2000, 53-105.

dates are back to normal prices with their next attestations, which are, however, at a somewhat greater distance of almost one a year (August 193 BC). Also, the scenario just contemplated is by no means unusual in Seleucid Babylonia. The best parallel is certainly the breakout of the First Syrian War in 274 BC, when at the diary AD -273B (line r29-r32) reports precisely such a conscription of troops to reinforce the royal army which already stood in Syria. Also in this case, the conscription was accompanied by significantly increased prices of various commodities, especially barley and cress. Throughout the period in which preparations for this war were undertaken in Babylonia, from November 274 to April 273 BC, barley stood at 5 shekel/*kurru*. This is about twice the average price of the early Seleucid period (2.57 shekel/*kurru*), and more than two and a half times the prevalent price of the 270s which usually stood below 2 shekel/*kurru*.[24]

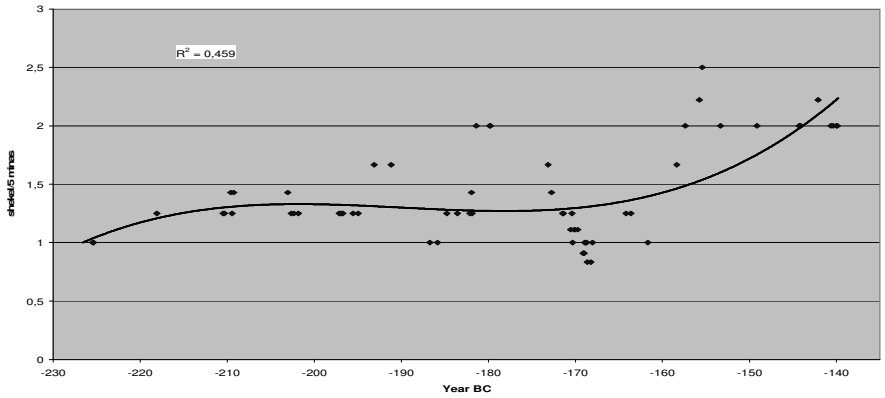
Also the data of the years after the price peak in 194 BC just discussed shows some peculiarities which need to be addressed. Date prices were highest in autumn 194 BC – thus immediately after the harvest, pointing to even higher prices during the rest of the year – and still remained above average also throughout the harvest year 192/1 BC at a level of about 1.2 shekel/*kurru*. In this latter instance, the high level can be perfectly well explained as caused by autocorrelation: high prices 194/3 BC caused prices to remain above average also during the following years. To assume an unknown exogenous shock is hardly necessary because although above average, these prices do not constitute outliers. As graph 4 below shows, dates occasionally achieved a price level between 1 and 1.5 shekel/*kurru* in the years between ca. 195 and 175 BC. The low mean price of 0.83 shekel/*kurru* is influenced strongly by the continuous decline in the price throughout the first half of the 2nd century BC, with the most pronounced trough dating to the period ca. 170-165 BC. Seen in this light, prices are not extraordinarily high in 192/1 BC. A similar explanation of autocorrelation can be adopted for the sesame price. After the very high prices between late autumn 194 and spring 193 BC, prices were still clearly above average in summer 192 BC. It was with the following harvest between September and October of 192 BC that the price dropped significantly from 10 to 6 shekels/*kurru*.[25] The barley price, on the other hand shows above average prices already in

[24] For cress, the mean of the early Seleucid period amounted to 6.10 shekel/*kurru*, but in the period late autumn 274 BCV to spring 273 BC, this value rose to 22.5 shekel/*kurru*. Also the mustard and (to a small extent) sesame prices were above average in this period. The fact that date price remained at an average level can be explained by the fact that the abundant supply in the period immediately after the harvest (taking place in October) could absorb the increased demand.

[25] The mean price of sesame in the late Seleucid period was 6.90 shekel/*kurru*. Sesame was a summer crop and as such harvested in autumn, from September onwards (Charles 1985, 45-50). See, however, the cautious

196/5 BC, and thus two years before the 'crisis' year of 194/3 BC. However, the prices in 196/5 BC were not only clearly below the level of autumn 194 – by one shekel and more –, they also seem to have recovered to a level almost in line the average price (1.67 shekel/*kurru*) with the harvest of 195 BC. Unfortunately, the one and a half years between that harvest and the peak price in October 194 BC are not covered by any prices at all, precluding further analysis. However, considering the ubiquity of the price increase of 194 BC, a connection to the higher barley prices of the harvest year 196/5 BC cannot be taken for granted and was at best indirect– and only effective if prices were high throughout the undocumented year 195/4 BC as well.

A final observation regarding the barley graph is that also during the early 170s BC, roughly between February 180 and January 177 BC, prices were at an above average level. Again, this period of above average prices doe not exclusively concern barley but also other commodities. The date price starts to oscillate at a level between 1 and 1.25 shekel/*kurru* simultaneously with the increase in the barley price in February 180, and until January 177 BC, the date price did not return below the 1 shekel mark. Also the generally stable wool price shows the highest price level since the troubled 230s BC. However, the two shekel/*kurru* mark was reached already before both barley and dates showed increased prices, namely in August 182 BC. In that month, barley was still at below average 0.75 shekel/*kurru*, similarly dates only cost 0.45 shekel/*kurru*.



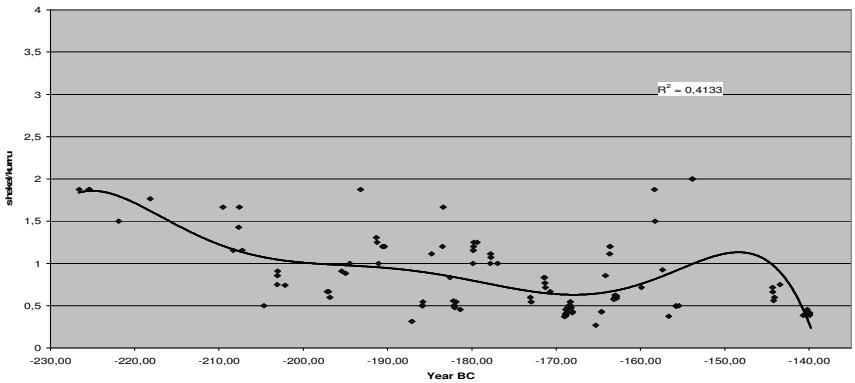
4. Wool prices in the later Seleucid period, ca.225-140 BC

remarks of Vargyas 2001, 242-244 and 250-251 as regards the difficulty of establishing patterns of seasonality with sesame. One explanation of the often inconclusive pattern might be that an early planted variety smoothens out seasonal variation, see Stol 1985, 119.

Cress on the other hand did not show higher price during the years in question (graph 3), and neither does *kasû*. Sesame had been on an above average price level through most of the 180s already and remained expensive in the years between 180 and 177 before dropping to a below average level in the second half of that decade. The price peaked in August 182 BC and again in April 178 BC at a level of 10 shekel/*kurru* (and slightly more in the earlier instance). The impression one gets is thus one of a comprehensive price rise, affecting visibly at least four of the commodities, first sesame and wool and somewhat later also the staple crops barley and dates. The main obstacle in interpreting the data of these years is the fact that the reign of Seleucus IV, as said above, is scantily documented. As neither a case for an increase in demand nor for a fall in supply (which is even less probable considering the universal nature of the price increase) can be made, a tentative explanation of this pattern focusing on the level of monetization might prove more promising. For Seleucia-on-the-Tigris, the main mint in the satrapy of Babylonia, A. Houghton established two subsequent types of tetradrachms, which are distinguished by their different ruler portraits (young man/older man) on the obverse.[26] A tempting hypothesis would be to associate this series of higher than average prices with an inflationary effect caused by the start of the issue of the second portrait type in Seleucia-on-the-Tigris. Additionally, the surprisingly high level of minting activity during the reign of the militarily rather inactive Seleucus IV pointed out by P. Mittag (2006, 122) and which he saw in connection with the payment of the war indemnities incurred by his father and predecessor Antiochus III with the peace treaty of Apameia,[27] has to be considered. As table 11.3 in Aperghis 2004 (240) shows, coin production was essentially on equal levels in the reigns of Antiochus III and Seleucus IV in a number of mints,[28] although the latter's expenses certainly were much reduced mainly due to the significant restriction on army size and composition after Apameia.[29] A high general level of mint production certainly favors such a scenario of inflationary tendencies, especially if not all coins minted were at once siphoned off into the treasuries of the Romans.

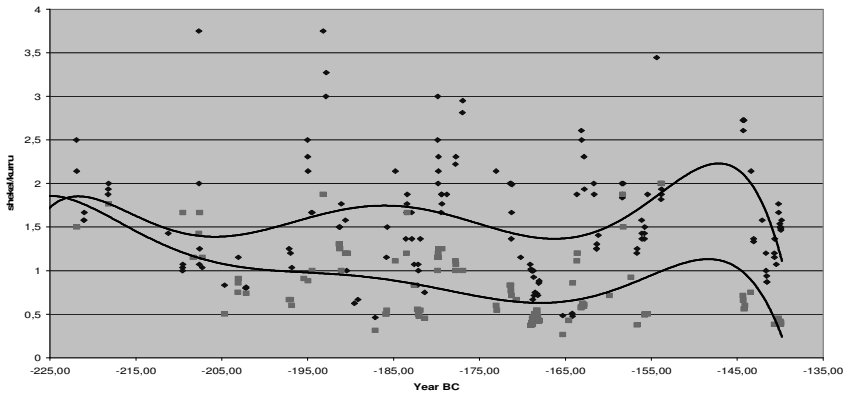
[26] Houghton *et al*. 2008 I, 3 and 25.
[27] Of the 15,000 talents of silver stipulated in this treaty, two thirds were to be paid in annual instalments of 1,000 talents. The last rate was actually paid in 173 BC only (and not in 178 BC, as the conditions in the contract required), this delay is usually attributed to the difficulty of the Seleucid empire in fulfilling these obligations, cf. Will 1979/82 II 303, Mittag 2006, 118.
[28] Susa and Nisibis (for the latter Houghton/Lorber 2008 I, 20-21 prefer now an identification as Damascus). The enormous difference in output in Seleucia-on-the-Tigris between the two kings is convincingly explained by Aperghis (2004, 239-242) as related to army payments of Antiochus III preceding his anabasis.
[29] G. G. Aperghis argues that the royal army even in peacetime consumed at least half of the total annual revenue of the Seleucid royal treasury, see Aperghis 2004, 189-205 and 211.

Turning now to the price patterns of commodities other than barley, the most peculiar trend-line is certainly shown by the graph of the date prices. At a satisfactory r^2 of 0.41, price decline steadily from the 230s until well into the 160s BC. After a rather unstable period with two particularly notable price peaks in the later 160s and 150s – late summer 159 BC, and late winter/early spring 154 BC – prices are back to a fairly low level of around 0.5 shekel/*kurru* and below in the second half of the 140s BC. The latest and highest of these peaks has been shown to have occurred together with a notable increase of the barley price, with the possible cause of inner tensions looming in the background. The peak of late summer 159 BC could be simply caused by the phenomenon of seasonal fluctuation as the two high prices of the year date to August and September respectively and thus to the immediate pre-harvest period. The cluster of above average prices in the early 170s BC as well as the outlier of October 194 BC have been discussed above and tentatively shown to be caused by phenomena affecting the prices the other commodities observed in the diaries, too. As was the case with barley, the mean price of dates during the late Seleucid period, 0.82 shekel/*kurru*, is significantly lower than during the early Seleucid period (2.25 shekel/*kurru*). The factor by which the price decreased was even larger, almost threefold. The margin between the mean date and barley prices had now widened again, to about 0.7 shekel/*kurru*. During the Late Achaemenid period this difference was even larger (1.35 shekel/*kurru*), however, in relative terms that picture changes. Barley was 1.67 times more expensive than dates during the Late Achaemenid period. In the late Seleucid period, barley cost 1.94 times more than dates, which were thus comparatively cheaper in the 2nd century BC than ever before. The widening of the gap between barley and date prices represents a return to conditions before the Seleucid takeover rather than an unexpected novelty, however, the magnitude is indeed surprising.



5. Date prices in the later Seleucid period, ca.225-140 BC

The price decrease in dates has been interpreted as a rather sudden drop manifesting itself in a year during the last decade of the 3rd century BC by G. G. Aperghis.[30] The trend-line in graph 5 above seems to cast doubt on Aperghis' interpretation of the price decline as an abrupt shock, as it clearly shows that prices decreased steadily from the 230s onwards already, and especially that the deepest troughs were reached in the 160s BC only, when price regularly moved below the 0.5 shekel/*kurru* mark (whereas e.g. in the late 190s the price returned consistently above the 1 shekel/*kurru* mark). However, what did indeed change significantly from the decade between 210 and 200 BC onwards was the relationship between barley and dates.



6. Barley and date prices in the later Seleucid period, ca. 225-140 BC

It is thus precisely from the point in time for which Aperghis postulated the price drop in dates that the divergence between date and barley prices increased massively. This phenomenon came about within a very short period, arriving at its fullest extent around 195 BC already. However, the reasons for this widening are thus also to be attributed to the development in the barley price showing a slight upswing between 195 and 180 BC, and not monocausally related to the development in the date price. The question is best rephrased as to why dates – contrary to barley – continued to fall after the last decade of the 3rd century BC. The earlier explanatory approaches of Van der Spek and Aperghis attributing the price decrease to a royal decree encouraging the plantation of new date palms or to a tax exemption on dates respectively both focused on the supply side. [31] However, as regards Aperghis'

[30] Aperghis 2004, 84 and figure 5.6.
[31] The idea that Antiochus III encouraged the planting of date gardens by means of a royal decree was favoured by Van der Spek 2004 and 2006, 302, whereas Aperghis (2004, 84) hypothesized taxation measures. See also Van der Spek/Van Leeuwen Brussels, where also a third possibility (increasing salinization affecting barley in stronger measure than dates) is briefly considered but judged unlikely.

hypothesis of the suspension of a 50% tax on dates there is no historical evidence whatsoever, neither for a 50% tax on the date harvest in Babylonia nor for an exemption thereof during the reign of Antiochus III.[32] Van der Spek's idea is based on a rental agreement from Uruk dating to 221 BC, which deals with the transformation of a plot of arable land into a date orchard and in which reference to a royal decree (*diagramma*) is made. In his interpretation, Antiochus III attempted to stimulate the planting of date gardens by means of issuing a royal decree.[33] However, also this interpretation has some difficulties. Most importantly, the text states nothing about the content of the royal edict. The passage concerning the planting of dates occurs several times in the text, and the one time it is juxtaposed with the royal decree is the passage specifying the modalities of the lease, immediately after the description of the property. It rather appears that the whole transaction is to be carried out under the regulations of a royal decree. It is for example conceivable the some kind of fee had to be paid for the transaction in order to be legally valid. Furthermore, a second reference to the (same?) royal *diagramma* is made in the same section in line 38 in connection with payments to be made to the temple (É DINGIR^{MEŠ}). Hence, as has been rightly recognized by Van der Spek (1995, 234), what seems to be at issue in this passage are the modalities of the payment of the rent. From that angle, the edict in question seems to have specified *inter alia* income rights of a temple leasing out land. Another argument against the interpretation of this royal edict as decreeing an increase in the number of date plantations is historical. The lease contract in question bears strong resemblance to the lease contracts *ana zāqipānūti*, "for the planting (of date palms)" which are known from the Neo-Babylonian period. In these contracts, the lessee obliged himself to plant a date grove on formerly unproductive land, as compensation he was allowed to keep the full amount of the harvest for himself in a number of years.[34] Furthermore, the subject matter was already known in the first half of the second millennium BC to the redactor(s) the Law Code of Hammurabi, which envisages in §§60-63 a scenario in which one citizen gives to another citizen a field which is to be turned into an orchard (*eqlam ana kirîm zaqāpim*). In §60, the Law Code indeed regulated the modalities of rental payment by the lessee in such cases, as was envisaged above. Hence, leases with the specific obligation

[32] Aperghis 2004, 146. He obviously assumes that the magnitude of the tax exemption corresponds precisely to the price decrease (or increase of the equivalent), thus to about 50%. Half of the harvest is a high but by no means unreasonable estimate for a tax on agricultural produce, in particular fruit crops; see Aperghis 2004, 137-152, especially 146.

[33] Van der Spek 2004 and 2006a, 302. The text is edited with translation in Van der Spek 1995, 227-234. See also Van der Spek 1986, 222-232, in particular the commentary to line 10 (230)

[34] See Jursa 1995, 122-124, and 2005, 22 for this type of contract. In his sample text (122, text 31), the lessee is exempted from rental payments for 12 years. A similar contract type – reclamation of barren land, *ana taptê* – existed also for agricultural land, see Jursa 1995, 140-143.

for the lessee to plant date palms are by no means an unusual phenomenon in first millennium BC Babylonia or earlier. To what use a tract of land was put depended primarily on soil conditions, the availability of water, labor force and farming equipment (such as plow oxen), and the concrete aims of the lessor, whether institutional household or private person. That kings attempted to generate additional income by means of regulating which crops were to be planted in a specific region of their empire is to the best of my knowledge an unknown economic strategy in ancient Babylonia.[35] The specialization in date horticulture of the Ebabbar temple in the 6th century BC came about due to various structural and other factors – such as the availability of manpower required for the intensification of agricultural production – but was certainly not prescribed by the royal chancellery.[36]

In the light of these difficulties it might prove rewarding to approach the subject from a different angle and put the focus on possible changes in the demand situation. A sustained decrease in the demand for a basic foodstuff such as dates as is implied in our data can only be explained by a significant change in the consumption behavior. Considering the essential stability of dietary habits prevailing throughout Ancient Near Eastern history, such a scenario, however, is not easily postulated. The only suitable context for such an unprecedented change in consumption patterns during the whole Seleucid period is provided by the settling of Greek colonists in the city of Babylon. The date of this Greek 'colonization' of Babylon is not established with absolute certainty, but as T. Boiy has shown, there is good evidence to date this event already during the reign of Antiochus III (rather than Antiochus IV).[37] The Greeks were not accustomed to rely on staple crops other than cereals (wheat and barley), and neither were they acquainted with the main Babylonian beverage, beer brewed from dates and seasoned among other with *kasû*.[38] Hence, we expect their dietary preference for barley (but also other cereals not recorded in the ADs)[39] to have driven up demand for and cultivation of barley as well as to have caused a decrease in the demand for dates (and *kasû*). As at least part of the colonists can be expected to have been provided with means of sustenance by the royal administration in form of fields (*kleroi*),[40] a rise in the barley production counterbalancing the increased demand can account for the fact that there was no drastic increase in the barley

[35] For the Seleucid empire, see the discussion of the imperial revenue in Aperghis 2004, 137-179.
[36] Jursa 2010, 355-360.
[37] Boiy 2004, 207-208. Cf. the commentary to AD -187A r9 for an ample discussion of the evidence and further arguments in favour of his hypothesis. The *locus classicus* for a date under Antiochus IV is Van der Spek 1986, 71-78.
[38] See Stol 1994 on the brewing of beer in first millennium BC Babylonia.
[39] A brief account of the standard Greek diet in antiquity is provided by Migeotte 2009, 75-78.
[40] See G. Cohen 1978, 21-25 on colonization in both urban and rural contexts.

price visible in the data. A problem is that we do not know whether the Greek settlers consisted of a number of persons elevated enough to leave a mark in the price data, however, as they were recognized as political entity within the city (*puliṭānu*/politai) we should not underestimate their economic force.[41] An additional argument for this line of interpretation is the fact that at about the same time, a drop in the price of *kasû* similar to that of dates occurred.[42] Hence, both main ingredients of Babylonian beer seem to have sustained a lack of demand at the same time. *Kasû* approximately halved in price, from a mean of 0.93 shekel/*kurru* in the period ca. 300-225 BC to mere 0.43 shekel/*kurru* during the later Seleucid period.

Summing up, the decline in the prices for *kasû* and especially dates both absolute and relative compared to barley is best approached focusing on the demand side. T. Boiy's hypothesis of the installation of a Greek colony in Babylon already under Antiochus III although it cannot be proven with absolute certainty would provide an ideal background to such the explanatory model provided here, which accounts more accurately for the trend in the price data than earlier scenarios centering on supply.

A final point of interest for the late Seleucid period under discussion are the notably low prices occurring in October/November 188 BC and in the years 166-165 BC. The table below shows that the two periods display, however, very different characteristics. For the former, the universal nature of the price decline cannot be doubted. All commodities attested (five out of six) show a price level two to three times below the average of the period. The universality of the price decrease as well as the remarkable evenness as regards its magnitude among the various commodities[43] strongly argue against either demand- or supply-centered approaches, which rather affect individual commodities or groups thereof (as in the case of the army convocation in the context of the First Syrian War (274 BC) driving up the price of barley and cress only) and also to different degrees. If we now consider a monetary explanation, the one events that immediately jumps to mind is of course the peace treaty of Apameia concluded in the same year, which obliged Antiochus III to the payment of 15,000 talents of silver, of which 5,000 talents plus a first annuity of 1,000 talents of the remainder had to be settled still in 188 BC. The very low prices – high commodity equivalents for silver

[41] See e.g. Van der Spek 2001 and 2009 and Sherwin-White/Kuhrt 1993, 149-161 on the Greek community in Babylon.
[42] Already Aperghis 2004, 85 and figure 5.7.
[43] In the earlier instance of 188 BC, the magnitude of the price decrease ranges between ca. two times for *kasû* and cress and more than three times for barley. An important factor in explaining the various impacts of one and the same phenomenon is the different demand elasticity of the commodities, see the paper of N. Mayhew.

– are thus best explained as being caused by a scarcity of silver. Over the following two years, price returned back to normal levels. Both barley and dates were still below average in March 186 BC when barley stood between 1.1.5 and 1.50 shekel/*kurru* and dates at 0.50-0.55 shekel/*kurru*, but already clearly above the level of 188 BC. Both commodities were back to their respective average levels (dates even above average) in spring 185 BC. *Kasû*, cress and sesame were back to an average level already in 186 BC. Wool was not attested in November 188 BC, but was at a level below average – between 1 and 1.25 shekels per 5 minas – for the remainder of the 180s BC. The first signs of a deflationary movement in connection with the Roman war of Antiochus III are maybe already visible in the barley data for 190 BC when the price oscillated between 0.63-0.67 shekel/*kurru*. However, as there is no price data from any of the other commodities extant from that year, there is no way to tell whether this movement was confined to barley (and e.g. caused by an exceptionally good harvest) or whether the expenses of the war left traces in the Babylonian price data already before drain caused by the indemnity stipulated at Apameia.

Commodity	**Mean price**[44]	**188 BC**	**166 BC**	**165 BC**
Barley	1.59	0.46	0.48	0.475
Dates	0.82	0.32	0.27	0.43/0.86
Kasû	0.45	0.2	-	0.25
Cress	3.30	1.5	-	3/4.29
Sesame	6.90	2.73	-	-
Wool	1.42	-	-	1.25

The price pattern of 166-165 BC is more difficult to explain. The barley price was below average in the first half of the 160s BC and plummeted to an extremely low level in the period between autumn 166 and autumn 165. However, in the pre-harvest season of the same harvest year, in late winter 164 BC barley all of a sudden disappeared from the market, and in May 164 BC, after the ensuing harvest, barley was at an above average level (1.88 shekel/*kurru*). Dates, on the other hand, were at an exceptionally low level only in October 166 BC (0.27 shekel/*kurru*), during the course of the year 165 BC they rose from 0.43 shekel/*kurru* in spring, and contrary to the usual pattern of seasonal fluctuation, to 0.86 shekel/*kurru* in October and were thus back to an average level. In the years between 170 and

[44] All prices in this table are in shekel per *kurru*, with the exception of the wool price which is given in shekels per five minas. The mean price refers to the period ca. 225-140 BC.

165, dates were similar to barley at a level constantly below average. *Kasû* stood very low in October 165 BC (0.25 shekel/*kurru*), whereas the attestations for cress show prices at (spring 165 BC: 3 shekel/*kurru*) or above average (4.29 shekel/*kurru* in October 165 BC). The price for sesame moved in general below average for most of the 160s BC, in October 165 BC the price stood at 4.29 shekel/*kurru*. Hence, as far as the evidence at hand allows us to tell, the main price trough was reached in autumn 166 BC, after which date prices slowly rose back to normal levels, with the exception of barley, which suddenly disappeared from the market in February 164 BC. As again all attested commodities are affected – but alas, only prices for barley and dates are extant – and the magnitude is again about the same (a decrease by three) a monetary shock is again a likely solution. It is tempting to connect the envisaged silver scarcity leading to high equivalents to the festivities in Daphne taking place in the same year, which were to inaugurate the Eastern campaign of Antiochus IV.[45] Considering the amount of wealth displayed at the *pompē*, requisitions of precious metals are not an unlikely scenario, especially if one considers that additionally also the army to accompany the king on campaign had to be remunerated. That the finances of the royal treasury were somewhat strained after the Roman wars is indicated by various attempts at closer control of temple finances and episodes of outright plundering in various regions of the empire during the reign of Antiochus IV. The most famous event is certainly the enduring rebellion in Judea under the Maccabees,[46] but also the installation of a *zazzaku* in the Esangila in Babylonia probably served the purpose of getting a tighter grip on the finances of the main Babylonian temple.[47] Antiochus IV even lost his life in an attempt to plunder the sanctuary of a female deity in Elam.[48]

The rising prices for dates and cress in 165 BC seem to constitute a rather quick – in the case of dates even contrary to the usual seasonal pattern – return to normal conditions. The main difficulty for that year is certainly the still extremely low barley price and its sudden rise in spring after a market collapse in January/February 164 BC. Cress, sesame and wool are attested at average prices in the period February-May 164 BC, it is thus only the data on barley that requires special explanation. Unfortunately, the historical sources are virtually absent for winter/spring 164 BC. Antiochus is known to have successfully campaigned in Armenia in early 165 BC, and very likely visited the region of the Persian Gulf (Antiocheia-

[45] Mittag 2006, 282-295, providing an exhaustive overview of the earlier literature on this event (282[1]).
[46], Mittag 2006, 225-281 and Will 1979/82 II, 326-341, both with additional literature.
[47] A *zazakku* was a royally appointed official in charge of temple finances, see Boiy 2004, 210, Dandamaev 1994.
[48] Mittag 2006, 307-310.

Charax) in October of the same year.[49] If this reconstruction of events is correct, he very likely passed through Babylonia in summer/early autumn of the same year, probably along the Tigris and thus bypassing the city of Babylon.[50] Events afterwards until his death roughly one year later are completely in the dark. What is striking in this scenario is that contrary to previous experiences the presence of an army in Babylonia did not cause barley prices to rise but was accompanied by some of the lowest prices throughout the period of the dataset provided by the ADs. Unfortunately, the reason for this unusual development – a royal edict prescribing artificially low prices for the sustenance of his troops leading to a depletion of all available stocks, for example – has to remain object of speculation.

3. Categories of exogenous shocks: Monetary shocks

As the preceding pages have shown, it is indeed possible to relate outliers in the price data to exogenous shocks of various natures. However, some of the connections made, such as the high barley price in autumn 145 BC due to marauding troops or the low prices caused by a scarcity of silver in the aftermath of the treaty of Apameia, are quite uncomplicated and appear more convincing than others, which rely upon controversial interpretations of the historical data, for example the foundation date of the Greek colony in Babylon, or for which the price data shows a rather ambiguous pattern. To tackle this problem, a different way of approaching the data needed to be devised. Rather than focusing from the outset on a possible correlation between prices and history, instances of a certain type of event – in the present case monetary shocks, but also domestic warfare, warfare outside of Babylonia, rebellion in Babylonia, natural disasters are possible categories – independent of the prices prevailing in the year of occurrence shall be identified throughout the time-span of the data. In a final step, the presence or absence of the respective type of event shall be considered in a regression analysis as dummy variables. In order to account for debatable interpretations of the historical data (rather than discarding them *ab initio*), a third category in addition to YES and NO was applied, namely UNCLEAR. A prime example of the last category is the short period of high prices in the early 170s BC during the reign of Seleucus IV which may or may not have been caused by the beginning of the issue of the second series of tetradrachms from Seleucia-on-the-Tigris. Ultimately, these regressions applied to the different categories of historical events

[49] AD -164B+C, Gera/Horowitz 1997, Mittag 2006, 296-307.
[50] Gera/Horowitz 1997, 247.

will provide us with formal statements as to whether the respective categories of exogenous shocks identified had a systematic impact on prices. They will thus provide an alternative perspective in the matter of exogenous shocks and Babylonian prices.

In a first step, the possible instances of monetary shocks shall be discussed. By monetary shock, an increase (positive shock) or decrease (negative shock) in the total amount of silver in circulation is meant. We expect thus a positive monetary shock to cause an inflationary movement, i.e. rising prices because the monetary supply increases also relative to the supply of commodities; in other words, the purchasing power of money depreciates. In the discussion of price volatility in the preceding section, the example of the silver drain connected with the indemnity payments stipulated by the treaty of Apameia has shown that this particular category potentially exerts very strong influence on price developments.

For the period of the dataset of prices from the ADs ca. 400 to 140 BC, the most notable increase in the monetary supply happened after Alexander the Great's conquest of the Achaemenid realm when the treasures amassed by the Great Kings – or at least parts thereof – were struck into coinage.[51] However, there are several problems attached to this episode that need to be addressed before further investigation, the first one being that we do not know precisely over what period the silver stocks of the treasury were minted and put into circulation. The estimates and calculations of previous research on this topic usually give a period of roughly 40 years and thus the whole of the period of warfare between the Successors.[52] G.G. Aperghis prefers a much shorter space of time, assuming that the main part of the treasure had been coined already before Seleucus' rise to power in Babylonia.[53] This latter approach, which is based on Justin's (XII 1 9) statement that only 50,000 talents of silver were left at the time of Alexander the Great's death is rather unconvincing due to historical reasons: all ancient historiographers agree that the bulk of the treasure was stored by

[51] According to Strabo XV 3.9, the total amount of the treasure of the last Achaemenid king Darius III amounted to 180,000 talents of silver, which corresponds to more then 5,000 metric tons. Adding the subtotals given in Quintus Curtius for the different treasuries of the empire, one arrives at the same sum; 4,000 talents in Arbela (V I 10), 50,000 talents in Susa interestingly specified as *non signati forma sed rudi pondere*, "not in coined form but as ingots" (V ii 11), 120,000 talents in Persepolis (V vi 9), and 6,000 talents in Pasargadae (V vi 10). Also the numbers given by Diodorus are in a similar range, e.g. for Persepolis he equally gives 120,000 talents of silver (XVII 71.3). According to the calculations of G.G. Aperghis (2004, 248-251), the total annual revenue of the Seleucid kings amounted to 15,000-20,000 talents of silver, the booty captured from the Achaemenid kings corresponds thus roughly to 9 to 12 times the annual income of the Seleucid empire, the largest of the Hellenistic kingdoms.

[52] De Callataÿ 1989, and similarly Temin 2002, 56. Note that Grainger 1999, 318 attributes generally little importance to the silver influx from the Achaemenid treasuries in his explanation of the high prices of the last quarter or so of the 4th century BC.

[53] Aperghis 2004, 214, cf. also his conference contribution.

the Persian kings in Persepolis and Susa, and according to both Strabo (XV 3 9) and Diodorus (XVII 80 3) Alexander's central treasury was established at Ecbatana. Considering that the main source of expenditure were the armed forces and that Alexander campaigned with his army in the East for the years to come and did not return to Babylonia before early 323 BC, a major influx of silver should not have taken place before that date, or only slightly earlier with the arrival of advance parties.[54] G. Le Rider additionally points to substantial financial needs of Alexander beyond military expenses during these years on campaign (city building, court expenses, and more). Of particular interest in his discussion are several passages in found Curtius Rufus and Plutarch showing that substantial amounts of precious metals were accompanying the army trek on the backs of mules and camel.[55] On the other hand one has to consider that soon after the capture of Babylon – the exact point in time is elusive – the city was made center of the financial administration of the empire, and additionally a prolific mint, the first major one operating in the east of the empire, was opened.[56] Especially during the tenure of office of the notorious squanderer Harpalus between ca. 327 and 325 BC one might expect that more silver than was salubrious for the market for basic commodities was put in circulation. A first quantification of the output of the Babylon mint yields a surprising result: according to G. Le Rider (2003, 318-319), only 1,750 talents of silver were struck during Alexander's lifetime mainly into tetradrachms, the by far most common denomination of that period. However, his method is somewhat flawed as he takes into account only extant obverse dies.[57] Additionally, he assumes a very low per-die productivity of 20,000 coins. His estimate is thus certainly too low. But also a more sophisticated approach gives an only marginally higher coin output. Based on the treasure of Demanhur (630 tetradrachms using 172 different obverse dies from Babylon), we expect a total number of about 203 obverse dies used in the mint of Babylon in the period between ca. 324 and 318 BC according to the Carter method.[58]

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[54] This presupposition that the Persian treasures were mainly used to pay for army wages is virtually undisputed in modern scholarship, see e.g. Temin 2002, 56, Le Rider 2003, 312, Bresson 2005, 48. That the army was by far the largest post in the expenditures of the Seleucid kings has been demonstrated by Aperghis 2004, 189-205, see also 236-245 for his concept of 'wartime' coinages. See also the interesting assessment of modern European states by de Callataÿ 2000, 337-341; this article is generally a powerful case for warfare as major cost factor throughout history, cf. his conclusion that "l'essentiel des monnaies a servi à pater l'armée" (355).

[55] Le Rider 2003, 310-316, in particular 311-312 for the accounts of Curtius and Plutarch.

[56] Le Rider 2003, 270-273, Boiy 2004, 44-45 and 107-110, Heller 2010, 401-403. The major known financial officers were Asklepiodorus, son of Philon, Antimenes of Rhodes, and Harpalus.

[57] He also considers extant dies of dekadrachms and gold staters, which he converts into tetradrachm equivalents, see Le Rider 2003, 318-319.

[58] See the concise description of this method in Esty 1986, 203-204. This method was also employed e.g. in de Callataÿ 1989, 265-266 (with a table of E.T. Newell's analysis of the tetradrachms of the Demanhur-treasure). Aperghis 2004, 240 in his table 11.3 made used of the still more complex method suggested by Esty 1986, 204-27 (also briefly described by Aperghis 2004, $17^{(+29)}$). In the light of the ratio coins/dies in the Demanhur-

At an output per die of about 30,000 coins as suggested by de Callataÿ,[59] we arrive at 4,060 talents of silver minted at Babylon (corresponding to about 6 millions of tetradrachms) in these years: at first glance a low amount compared to the total of 180,000 talents, but when converted into the metric system, the conclusion that the minting activity of these years is at least part of the explanation for the increased prices seems inevitable: within six years only, roughly 146 metric tons of silver were put into circulation in form of tetradrachms. The focus on the increased activity of the mint also provides a tempting explanation as to why prices started to increase Babylon during Alexander's lifetime already.

The following question is now for how long money was minted in Babylon at such an elevated level which might be responsible for increased prices. One certainly has to account for the fact that the Achaemenid treasure was spent to a large part in forms other than coinage – one just has to remember Diodorus' description of the sumptuous chariot which was to transport Alexander's body back to Macedonia (XVIII 26.3-28.1) as an instructive example of the many ways in which the silver and gold looted were used – and also for a considerable amount of the booty being used up and carried off by Antigonus the One-Eyed during his reign over Babylonia (ca. 316-311 BC). However, there is good evidence that during the reign of Seleucus I (including also the years before his acceptance of the royal title in 305 BC) the mint of Babylon was disproportionately productive. As can be seen in the table below, there is an enormous discrepancy in the number of annual coin issues particularly from the mints in the eastern half of the empire (Seleucia-on-the-Tigris, Susa and Ecbatana) between Seleucus I and his successors. This can be interpreted as resulting from the large reserves of precious metal at still at the disposition of first ruler of the dynasty, who consequently could mint coinage with a frequency no longer possible for the later kings. The frequent military campaigns of Seleucus I – the struggle for Babylonia against Antigonus and his son Demetrius first, then the campaign into India resulting in a treaty with Chandragupta Maurya, and finally his western campaigns culminating in the final defeats of Antigonus (at Ipsus 301 BC) and later Lysimachus (at Corupedium 281 BC) – can only partially explain this difference in output. A comparison with the output of Antiochus III who similarly spent many years of his reign on campaign shows that the annual output was significantly higher during the reign of Seleucus I.

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treasure, the results are essentially the same for both approaches, cf. Esty 1986, 204. As regards the date of the issues of the Alexander-type tetradrachms, we follow Le Rider 2003, 297-299.

[59] de Callataÿ 1989, 271-272 and 2005, 77-78.

Ruler[60]	Reign (BC)	Mint	Number of tetradrachm issues[61]	Issues/year[62]
Seleucus I	311-281	Babylon	46	2.7
		Seleucia-Tigris	128	9.85
		Susa	48	1.6
		Ecbatana	55	1.83
		Antioch-Orontes	6	0.3
		Laodicea-Sea	8	0.4
Seleucus II	246-226	Seleucia-Tigris	7	0.35
		Susa	7	0.35
		Ecbatana	7	0.35
		Antioch-Orontes	14	0.7
Antiochus III	222-187	Seleucia-Tigris	24	0.69
		Susa	18	0.51
		Ecbatana	12	0.48
		Antioch-Orontes	44	1.26
		Laodicea-Sea (?)	21	0.6

The surprisingly high difference in issues between Seleucus I and Antiochus III needs to be put in context. Under the later king, the minting system seems to have been less centralized, to the issues in the table above one has to add notable tetradrachm outputs in Sardis (14 issues), Soli (14 issues) Tarsus (17 issues), the "Rose" mint, perhaps from Edessa (14 issues), the so-called ΔI-mint in southern or eastern Syria (14 issues), and especially the "Uncertain mint 68, in Mesopotamia" (36 issues).[63] Another difference is that Antiochus III inherited from his predecessors a well-established monetary system whereas at the moment of Seleucus's takeover in 311, coinage based on the Greek standard had just been introduced

[60] See also Houghton 2004, 74 (Table I) for a similar overview of issues according to geographical region for the Seleucid kings between 246 and 165 BC (Seleucus II to Antiochus IV).
[61] The table was compiled on the basis of the overview in Houghton/Lorber (2002 II, 133-156). In case of a mint producing different types of tetradrachms, e.g. with Zeus Aetophorus or Zeus Nikephorus on the reverse, the different issues were simply added up. An issue is defined by Houghton/Lorber as coinage "with unique types, inscriptions, controls and/or control positions" (133). Only issues that were definitely attributed to the respective mints were considered.
[62] The mint at Babylon closed already around 294 BC (Houghton/Lorber 2002 I, 40), on thus has to reckon with a period of 17 year (311-294 BC) during which coins were struck at this mint. Afterwards, the atelier was replaced with Seleucia-on-the-Tigris, to which an active period of 13 years is assigned for the reign of Seleucus I. The ateliers at both Antioch-on-the-Orontes and Laodicea-ad-marem came into the possessiom of Seleucus I possession only after the victorious battle at Ipsus in 301 BC.
[63] Houghton/Lorber 2002 II, 152-156.

with the arrival of Alexander's army. Hence, the substantially higher level of coinage output during the reign of Seleucus I should in part be attributed to an inadequate base supply of money, a factor which gains additional importance when considering the above-average demand of the royal administration for money in order to satisfy its military expenses during the reign of this king. Especially the tetradrachm type depicting Zeus on the obverse and an elephant chariot on the reverse, which with 82 issues is by far the most numerous series from Seleucia-on-the-Tigris seems mainly to have served the purpose of monetization of the new capital city and its environs.[64] In the light of these results it is beyond question that period of intense minting activity which began (in the chronology of Le Rider) around 324 BC continued far into the reign of Seleucus I.[65] What we do not know, however, and this is the main problem as regards the use of the dummy variable "Positive monetary shock" in a regression analysis, are the exact years during which coinage was struck, not to speak of the respective quantities. In the light of the findings of A. Houghton and G.G. Aperghis of increased minting activity during period of warfare in order to pay for armed troops rather than continuous activity at a somewhat lower level,[66] important outputs of the Babylonian mint should be dated to the years between 323 and autumn 320 BC (arrival of Seleucus, to whom the satrapy was awarded at the conference of Triparadeisus), to 318/7 BC when Babylonia was invaded by Eumenes and his troops,[67] and to the years of the final battle for Babylon between Seleucus and Antigonus and Demetrius between 311 and 308 BC. Also for 316 BC, when Antigonus returned victoriously with his army from Gabiene to Babylon with 20,000 talents of silver seized in Susa (Diodorus XIX 55) higher minting activity can be reasonably postulated. The period of intense minting in the city of Babylon shortly before and shortly after Alexander the Great's death (ca. 324-318) as well as the not negligible issues of

[64] According to Houghton/Lorber 2002 I 52, this type of coinage mainly circulated in Babylonia.
[65] An alternative methodology, namely a comparison of extant and estimated obverse dies from Seleucia-on-the-Tigris from the reigns of Seleucus I and Antiochus III would possibly yield a more accurate result as regards total output. However, as the numbers found in the secondary literature vary to a considerable extent such an exercise should ideally start with an exact assessment of both extant obverse dies and extant coins, which clearly lies beyond the scope of present work. In general, the information found in recent secondary literature does not point to fundamental changes of the results here obtained: for the reign of Antiochus III, G.G. Aperghis (2004, 239-240 and table 11.3) refers to a number of 49 extant obverse dies from Seleucia-on-the-Tigris, based on a 1993 counting of G. Le Rider; Houghton 2004, 77 has already 69 obverse dies (see also 53[17]) for that mint under the same ruler. For the reign of Seleucus I, the only count available to me was Newell 1938, which already gave 73 extant obverse dies. In the light of the very low ratios obverse dies: reverse dies and obverse dies: specimens, and accounting for discoveries made since his study, this number is most likely to have increased considerably.
[66] Houghton 2004, 52-54, Aperghis 2004, 236-242. The latter distinguishes between peacetime and wartime coinages, representing regularly needed replacement money and additional expenses of warfare respectively.
[67] BCHP 3, 29-30 speaks indeed of a forceful levy of silver in September/October 318 BC. Van der Spek in his completion of the line at livius.org hypothesizes that it was destined for army payments. As regards the notoriously elusive chronology of the Hellenistic period, in particular the years between ca. 323-310 the reconstruction of Boiy 2007 is followed here.

lion staters during the tenure of office of the satrap Mazaeus (330-328),[68] on the other hand, are less problematic to date and thus easier amenable for treatment as dummy variables in a regression analysis.

The closure of the Babylon mint in or around 294 BC is unlikely to have caused a negative monetary shock as the city was from that moment on provided with coinage from Seleucia-on-the-Tigris. A coin hoard from the city of Uruk shows that the mint at Seleucia quite likely provided the whole of the satrapy of Babylonia with all kinds of denominations, including bronze coinage.[69] As was shown by G.G. Aperghis (2004, 214-216), such a pattern of a major mint in provincial centers is by no means an unusual pattern in the Seleucid empire. In the preceding section we have tentatively drawn a connection between high prices in Babylon and coin issues in Seleucia during the reign of Seleucus IV between ca 180 and 177 BC (see above). It is of course not admissible to retain this hypothetical explanation of high prices as a certain case of a "positive monetary shock" in the regression, – this would amount to circular argumentation – but as the idea should neither be excluded, we will keep this episode as uncertain case. In this context it is important to mention that the absence of a positive monetary shock in the regression does not mean that no coins were issued in that year in Babylonia, but rather that no such quantity as to have an impact of prices was coined and put into circulation. A possible distortion of the monetary balance might have been caused by the substantial issues of Antiochus III from Seleucia-on-the-Tigris, which were dated by A. Houghton[70] to the years of the rebellion of Molon (ca. 222-220), to the period preceding Antiochus' *anabasis* into the eastern provinces (ca. 211-210 BC) as well as to the return of the army from said campaign (ca. 204 BC). For these years, a positive monetary shock will be assumed.

Cases to be interpreted as negative monetary shocks, thus withdrawals of silver from Babylonia causing a rise of its exchange value vis-à-vis commodities are less easily found. A first instance is the war preparations in Babylon for Antiochus' counterattack in the First Syrian War. The Astronomical Diary -273B (r30-33) explicitly mentions that among other goods such clothes and battle equipment also silver from Babylon and Seleucia-on-the-Tigris was sent by order of the satrap to the royal army already encamped in the province of *Ebir*

[68] On his coinage see Le Rider 1993, 274-276.
[69] Leisten 1986, especially 336 his conclusion of a "fast vollständigen Abhängigkeit Orchois von der Münzstätte in Seleukeia".
[70] Houghton 2004, 53-54 and 75 (Table II).

nāri (Transpotamia). As a consequence, a scarcity of silver seems to have occurred (at least among the local population) so that transactions were increasingly carried out in "Greek copper (i.e. bronze) coins" (AD -273B, r33 and Upper Edge 2). This passage is best interpreted as scarcity of coinage among the local population due to requisitions rather than a general scarcity of silver in Babylonia which would be difficult to reconcile with both the pattern of increasing prices (hence a depreciation of the silver value) as well as with the not negligible coin output from the mint at Seleucia-on-the-Tigris during the reign of Antiochus I. However, also silver confiscations constitute a negative monetary shock, with the intensity and also the duration of the effect depending largely on where the money requisitioned was spent.[71]

Two further and also less problematic negative monetary shocks can be identified from the 2nd century BC (and were also discussed in the preceding section), the first one constituted by the peace treaty of Apameia in 188 BC, which obliged Antiochus III to the payment of an indemnity of 15,000 talents of silver to the Romans and in general is thought to have put a severe strain on the empire's monetary resources.[72] To a minor extent, also the display of wealth during the *pompē* at Daphne in 166 BC is not an unlikely candidate for a drain of the precious metal resources of several province of the empire.[73] Also the flight of Harpalus with 5,000 talents of silver in 324 BC could be thought to have constituted a drain of silver resources.[74] However, there is nothing to suggest that silver was withdrawn from circulation, which is an unlikely conclusion in the light of the 180,000 talents of silver recently conquered at disposal in the treasuries. That Harpalus' misappropriation of funds did not cause any scarcity of precious metal can also be deduced from the prolific activity of the Babylon-mint in the years following his flight.

This overview of the instances counted as monetary shocks shows immediately that this type of event occurred with particular frequency in the years immediately after the Greek conquest of Babylonia. This can be explained by the ready availability of bullion to be minted after the sack of the capitals of the Achaemenid Great kings. Also in the period afterwards, the case for a close relationship between warfare and monetary shocks can be made, suitable

[71] In the present instance it is assumed that the silver was spent for the most part again in Babylonia, with the demand shock caused by the conscripted troops triggering the observed price rises in barley and cress. Any effects of the hypothesized negative monetary shock in question are thus expected to have been effective for a brief period and with a low intensity only, the expected pattern is one of quick recovery to the former price level.
[72] Will 1979/82 II, 221-240.
[73] See Mittag 2006, 282-295 on the wealth displayed during this procession.
[74] Diod. XVII 108 4-8.

examples are the negative monetary shocks accompanying the preparations for the First Syrian War (274/3 BC) and in the aftermath of the treaty of Apameia ending the Roman Wars of Antiochus III (187 BC). As the different historical episodes, however, always consist of different combinations of possible shocks (e.g., both the First and the Third Syrian War saw the presence of an army in Babylonia, but only for the former a monetary shock in form of requisitions is attested), these interrelationships are fairly unproblematic.[75]

Year	Value[76]
330-328	1
324-320	1
318/7	1
311-308	1
274/3	-1
223-220	1
211-210	1
188	-1
180-178	99
166	-1

The results of a regression run for both positive and negative monetary shocks on barley prices under consideration of seasonality reveal these phenomena as very strong categories of exogenous shocks. The correlation coefficient of the dummy for positive shocks is at 0.91, the one for negative monetary shocks even higher at -1.32 (the minus sign meaning that negative monetary shocks decreased prices). This means that at each occurrence of a positive monetary shock, the log price of barley is raised by 0.9, corresponding to 2.4 shekels per *kurru*. As the mean price of barley during the whole Seleucid period (ca.330-140 BC) amounts to 2.09 shekel/*kurru*, this means, that on average, monetary shocks more than double the barley price in the short run.The probability of the result obtained is supported by the pattern of seasonality shown by the regression, according to which prices were highest in January (coefficient of 0.37) and lowest in May (0.05). Also the r^2 is satisfactory, amounting

[75] Proceeding by means of a separate regression for each category, the multiplicity of factors is easily accounted for as for the same year different shocks can be postulated. The magnitude of the individual correlation coefficients can then be used in attempting to answer the question as to which of the categories are more influential than others.

[76] The value 1 designates the factual occurrence of a monetary shock in the year in question, the minus sign is employed in this table simply to distinguish positive from negative monetary shocks. The value 99 means that an occurrence of a monetary shock is possible but cannot be proven with satisfactory certainty.

to 0.16.[77] The amount of price data counts 347 observations and is thus abundant enough to be employed for quantification; the *t*-values (at 7.6 for positive monetary shocks and -1.97 for negative monetary shocks) indicate that the results are significant also at 95%.

The methodology of regression analysis employing dummy variables to quantify the impact of political history on Babylonian commodity prices in form of exogenous shocks is thus a very promising approach. In particular, the possibility to refine and confirm the results of a simple discussion of the price against the historical background as well as the opportunity of formal proof are valuable additions to methodology employed thus far in the investigations of Babylonian prices.

[77] If the only hypothetical positive monetary shock in the early 170s is omitted, the results do not change significantly. The coefficient for the dummy even increases to 1.09, which shows that the rise in prices occurring in these years was lower than in other instances of monetary shocks. The r^2 in that case would amount to 0.18.

Literature and abbreviations

ADART:

Sachs, Abraham/Hunger Hermann, Astronomical Diaries and Related Texts from Babylonia, 3 Volumes: I: 652- 262 BC, Wien 1988; II: 261- 165 BC, Wien 1989; III: 164- 61 BC, Wien 1996.

Aperghis, G. 2004, The Seleukid royal economy. The finances and financial administration of the Seleukid empire, Cambridge

Boiy, T. 2004, Late Achaemenid and Hellenistic Babylon (OLA 136), Leuven

Boiy, T. 2007, Between high and low. A chronology of the early Hellenistic period, Frankfurt/Main

Bresson, A. 2005, Coinage and money supply in the Hellenistic age, in: Archibald, Z. *et al*. (eds.), Making, moving and managing. The new world of Ancient economies, 323-32 BC, Oxford, pp. 44-72

de Callataÿ, François 1989, Les trésors achéménides et les monnayages d'Alexandre : espèces immobilisées et espèces circulantes ?, in : REA 91, 259-274

de Callataÿ, François 2000, Guerres et monnayages à l'époque hellénistique, Essai de mise en perspective suivi d'une annexe sur le monnayage de Mithridate VI Eupator, in: Andreau *et al*. (eds.) Andreau, J. *et al*. (eds), Économie antique. La guerre dans les économies antiques (EAHSBC 5), Saint-Bertrand-de-Comminges, pp. 337-364

Charles, M. P. 1985, An Introduction to the legumes and oil plants of Mesopotamia, in: BSA 2, pp. 39-61

Cohen, G. 1978, The Seleucid colonies: studies in founding, administration and organization (Historia Einzelschriften 30), Wiesbaden

Dandamaev, M. 1994, The Neo-Babylonian *zazakku*, in: AoF 21, 34-40

Del Monte, G. 1997, Testi dall Babilonia Ellenistica Vol. 1: Testi cronografici, Pisa-Roma

Eckstein, A. 2008, Rome enters the Greek East: Form anarchy to hierarchy in the Hellenistic Mediterranean, 230-170 BC, Oxford

Ehling, K. 2008, Untersuchungen zur Geschichte der späten Seleukiden (164-63 v.Chr.): Vom Tode Antiochos IV. bis zur EInrichtung der Provinz Syria unter Pompeius (Historia Einzelschriften 196), Stuttgart

Esty, W. 1986, Estimation of the size of a coinage: a survey and comparison of methods, in: NC 146, 185-215

Földváry, P. *et al*., *forthcoming*, markets in pre-industrial societies: storage in Hellenistic Babylonia in the medieval English mirror, in: Journal of Global History
Gera, D./Horowitz, W. 1997, Antiochus IV in life and death: evidence from the Babylonian Astronomical Diaries, in: JAOS 117, pp. 240-252
Grainger, J. 1999, Prices in Hellenistic Babylonia, in: JESHO 42, pp. 303-325
Heller, A. 2010, Das Babylonien der Spätzeit (7.-4. Jh.) in den klassischen und keilschriftlichen Quellen (Oikomene – Studien zur anitken Weltgeschichte), Stuttgart
Houghton, A. 2004: Seleucid coinage and monetary policy of the 2nd century BC. Reflections on the monetization of the Seleucid economy, in: Chankowski, V./Duyrat F. (eds.) Le roi et l'économie. Autonomies locales et structures royales dans l'économie de l'empire séleucide (Topoi Suppl. 6), Lyon, pp. 49-79
Houghton, A./Lorber, C. 2002, Seleucid coins. A comprehensive catalogue, part II: Seleucus I through Antiochus III (2 Vols. I: Introduction, maps, and catalogue, II: Appendices, indices, and plates), New York
Houghton, A. *et al*. 2008, Seleucid coins. A comprehensive catalogue, part II: Seleucus IV through Antiochus XIII (2 Vols. I: Introduction, maps, and catalogue, II: Appendices, indices, and plates), New York
Jursa, M. 1995, Die Landwirtschaft in Sippar in neubabylonischer Zeit *(*AfO Beiheft 25), Wien
Jursa, M. 2005, Neo-Babylonian legal and administrative documents. Typology, contents and archives (GMTR 1), Münster
Jursa, M. 2010, Aspects of the Economic History of Babylonia in the First Millennium BC. Economic Geography, Economic Mentalities, Agriculture, the Use of Money and the Problem of Economic Growth, with contributions by J. Hackl, B. Janković, K. Kleber, E.E. Payne, C.Waerzeggers and M. Weszeli (Veröffentlichungen zur Wirtschaftsgeschichte Babyloniens im 1. Jahrtausend v. Chr. Band 4 = AOAT 377) Münster.
Leisten, T. 1986, Die Münzen von Uruk-Warka. Katalog der Münzfunde der Jahre 1913-1984, in: BaM 17, 309-367
Le Rider, G. 2003, Alexander le Grand: monnaie, finances, et politique, Paris
Ma, J. 2000, Antiochus III and the cities of Western Asia Minor, Oxford
Migeotte, L. 2009, The economy in Greek cities: Form the Archaic period to the early Roman empire
Mittag, P. F. 2006, Antiochus IV Epiphanes: Eine politische Biographie (Klio – Beiträge zur Alten Geschichte, Beihefte, NF Band 11), Berlin

Pirngruber, R. 2010, Seleukidischer Herrscherkult in Babylon?, in: Rollinger, R. *et al*. (eds.), Interkulturalität in der Alten Welt: Vorderasien, Hellas, Ägypten und die vielfältigen Ebenen des Kontakts (Philippika – Marburger altertumskundliche Abhandlungen 34), Wiesbaden, pp. 533-549

Pirngruber, R., *forthcoming*, Plagues and prices: Locusts, in: Proceedings of the START Project symposium "Too much data?" Vienna, 17-19 July 2008

Schmitt, H. H. 1964, Untersuchungen zur Geschichte Antiochus' des Grossen und seiner Zeit (Historia Einzelschriften 6), Wiesbaden

Sherwin-White, S./Kuhrt, A. 1993, From Samarkhand to Sardis: a new approach to the Seleucid empire, London

Slotsky, A.L. 1997, The bourse of Babylon. Market quotations in the Astronomical Diaries of Babylonia, Bethesda (MD)

Slotsky, A. L./Wallenfels, R. 2010, Tallies and trends. The Late Babylonian Commodity Price Lists, Bethesda (MD)

Van der Spek, R.J. 1986, Grondbezit in het Seleucidische rijk, Amsterdam

van der Spek, R.J. 1993, The Astronomical Diaries as source for Achaemenid and Seleucid history, in: Bi.Or 50, pp. 91-101

van der Spek, R.J. 1995, Land ownership in Babylonian cuneiform documents, in: Geller, M./Maehler, H. (eds.), Legal documents of the Hellenistic world, London, pp. 173-245

van der Spek, R.J. 1997/98, New evidence from the Babylonian astronomical diaries concerning Seleucid and Arsacid History, in: AfO 44/5, pp. 167- 175

van der Spek, R. J. 2000, The effect of war on the prices of barley and agricultural land in Hellenistic Babylonia, in: Andreau, J. *et al*. (eds), Économie antique. La guerre dans les économies antiques (EAHSBC 5), Saint-Bertrand-de-Comminges, pp. 293-313

van der Spek, R. J. 2001, The theatre of Babylon in cuneiform, in: van Soldt, W. *et al*. (eds.), Veenhof anniversary volume(PIHANS 99), Istanbul, pp. 445-456

van der Spek, R. J. 2004, Palace, temple, and market in Seleucid Babylonia, in: Chankowski, V. *et al*. (eds.), Le roi et l'économie. Autonomies locales et structures royal dans l'empire séleucide (Topoi Suppl. 6), Lyon, pp. 303-332

van der Spek, R. J. 2006, How to measure prosperity? The case of Hellenistic Babylonia, in: Descat, R. *et al*. (eds.), Approches de l'économie hellénistique (EAHSBC 3), Saint-Bertrand-de-Comminges, pp. 287-310

van der Spek, R. J. 2009, Multi-ethnicity and ethic segregation in Hellenistic Babylon, in: Derks, T. *et al*. (eds.), Ethnic constructs in antiquity. The role of power and tradition, Amsterdam, pp. 101-115

van der Spek, R. J./van Leeuwen, B. *forthcoming*, Quantifying the integration of the Babylonian economy in the Mediterranean World using a new corpus of price data, 400-50 BC

van der Spek, R. J./Mandemakers, C. 2003, Sense and nonsense in the statistical approach of Babylonian prices, in: Bi.Or 60, pp. 521-537

Stol, M. 1985, Remarks on the cultivation of sesame and the extraction of its oil, in: BSA II, pp. 119-126

Stol, M. 1994, Beer in neo-Babylonian times, in: L. Milano (ed.), Drinking in ancient societies. History and culture of drinks in the Ancient Near East (HANE/S 6), Padua, pp. 155-183

Temin, P. 2002, Price behaviour in Ancient Babylon, in: Explorations in Economic History 39, pp. 46-60

Vargyas, P. 2001, A History of Babylonian prices in the First millennium BC, 1: Prices of basic commodities (HSAO 10), Heidelberg

Wiesehöfer, J. 1994, Das antike Persien von 550 v.Chr. bis 651 n.Chr, Zürich/München

Wiesehöfer, J. 1998, Das Partherreich und seine Zeugnisse – The Arsacid Empire: Sources and Documentation (Historia-Einzelschriften 122), Stuttgart

Will, É. 1979/82, Histoire politique du monde hellénistique 323-30 av. J.-C.[2] (2 Vols, I : 1979, II : 1982)