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What is a housing bubble?

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Abstract

The aim of this paper is to look at the developments in previous housing price cycles to improve our understanding, and to create a descriptive definition, of what a house price bubble is and to lay the groundwork for future research. A descriptive definition opens a lot of research opportunities with empirical studies of large datasets, such as: How costly are housing price bobbles? Is there a pattern associated with bubbles? Which indicators can be used to identify bubbles? We find the peaks and troughs and study the price movements around these points using two datasets with housing price data. We use one quarterly dataset from 1970 to 2015 for 20 OECD countries, and one yearly set with 6 countries and 2 cities, where 6 of the data series go back to the 1800s. A large housing price bubble has a dramatic increase in real prices, at least 50% during a five-year period or 35% during a three-year period, followed by an immediate dramatic fall in the prices of at least 35%. A small bubble has a dramatic increase in real prices, at least 35% during a five-year period or 20% during a three-year period, followed by an immediate dramatic fall in the prices of at least 20%.

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1. Introduction

A descriptive house price bubble definition opens many research opportunities with empirical studies of large datasets, such as: Descriptive studies of what a housing price bubble really is or whether housing price bubbles typically coincides with bubbles in other asset markets. A descriptive definition also makes it possible to study the cost of housing price bubbles in a large scale and to make test bubble indicators to easier discover housing price bubbles in the future.

Asset price bubbles have long been of great interest to researchers. However, to our knowledge the literature that collects and analyses housing bubble in large datasets is limited. There exists one type of literature (e.g. Kindleberger and Aliber (2005) and Brunnermeier and Schnabel (2015)) that looks at the most prominent asset price bubbles from the past 400 years, including housing price bubbles, trying to identify the main characteristics of these bubbles. Another part of the literature (e.g. OECD (2005), André (2010), Angneller and Schukneat (2011) and Bracke (2013)) looks at the housing market in OECD countries after 1970, focusing on the characteristics of the boom and bust cycles. We construct and apply a mathematical bubble definition to both a long and short dataset, which allows us to categorize housing price cycles into large bubbles, small bubbles, and non-bubbles. We further use the characteristics of these categories to propose a simple bubble indicator.

There are many definitions of bubbles. Most of them are normative definitions, like that of Stiglitz (1990), that try to describe bubbles as periods involving speculation, or argue that bubbles involve prices that cannot be justified by fundamentals. Examples are Palgrave (1926), Flood and Hodrick (1990), Shiller (2015), Smith and Smith (2006) and Cochrane (2010).

Stiglitz' definition is reproduced below:

> "…the basic intuition is straightforward: if the reason that the price is high today is only because investors believe that the selling price will be high tomorrow—when 'fundamental' factors do not seem to justify such a price—then a bubble exists." (Stiglitz 1990, p. 13)

Hans Lind (2009) argued that we needed a new definition of price bubbles in the housing market, an "anti-Stiglitz" definition. His point is that traditional definitions such as that of Stiglitz (1990), in which bubbles are proposed as arising from prices not being determined by fundamentals, are problematic. This is primarily because the concept "fundamentals" is vague, but also because these type of nominal definitions typically do not refer to a bubble episode as a whole—with both an increase and a decrease of the price.

Lind claims that the solution is to define a bubble by focusing only on the specific development of prices and not on why prices have developed in a certain way. The general definition of a bubble would then simply be:

> "There is a bubble if the (real) price of an asset first increases dramatically over a period of several months or years and then almost immediately falls dramatically." (Lind 2009, p. 80)

In addition, Kindleberger (1987) has a more descriptive bubble definition:

> "A sharp rise in price of an asset or a range of assets in a continuous process, with the initial rise generating expectations of further rises and attracting new buyers—generally speculators interested in profits from trading rather than in its use or earning capacity. The rise is then followed by a reversal of expectations and a sharp decline in price, often resulting in severe financial or economic crises."

In his article, Lind expressed the desire that his framework and concept of bubbles be further developed through empirical testing, and that different interpretations of the general definition depend on the specific market.

The main advantage of our bubble definition is that it exclusively uses price data, which makes it simple to apply to any housing price series, without considering an equilibrium (fundamental) price. Our definition is technically easy to use, simple to understand, and sufficiently robust (considering the fact that our long dataset is constructed based on few observations).

To further clarify the term bubble, it is useful to introduce the concepts of overpricing and underpricing. These have wider definitions than bubbles. An asset may be overpriced without the existence of a bubble, but there cannot be a (positive) bubble without overpricing. Over- or underpricing are simply defined as deviations from the equilibrium price.

DiPasquale and Wheaton (1994) claims:

> "Indeed, it appears to be normal for housing prices to deviate from the fundamental value or equilibrium price, since housing markets clear gradually rather than quickly in a short run."

A bubble is a concept that describes something more extreme and rarer than the normal cycles of periods of over- and underpricing in the housing market. The price increase within a bubble is often associated with terms such as "mania," "euphoria" and "mass hysteria" (Kindleberger and Aliber, 2005).

Hans Lind (2009) proposes a general definition for the housing market as follows.

Dramatic price increase:

- Real prices having at least doubled during a five-year period.
- Real prices having increased by at least 50% during a three-year period.

Almost immediately falls:

- Lind argues that it is not very important where the line is drawn, but if we want a narrow concept of a bubble, around one to two years is the longest acceptable period between when the prices peak and subsequently start to fall.

Dramatic price fall:

- To demand that the prices have to fall back to the level before the bubble started may be too restrictive, Lind argues. In addition, a 50% fall must be seen as a dramatic fall in the property prices, even if the previous price increase was much larger.

We propose the following interpretations of Lind's bubble definition for the housing market:

> A large housing price bubble has a dramatic increase in real prices, at least 50% during a five-year period or 35% during a three-year period, followed by an immediate dramatic fall in the prices of at least 35%.
>
> A small housing price bubble has a dramatic increase in real price, at least 35% during a five-year period or 20% during a three-year period, followed by an immediate dramatic fall in the prices of at least 20%.

We apply these definitions to our datasets and present the results in section 4, which we reach through the following steps. First, as described in section 3.1, we use the Harding and Pagan (2002) algorithm to detect turning points in our data series. This gives us the cycles of house price upturns and downturns, ending in peaks and troughs, respectively. Then we apply our bubble definitions (which we discuss further in section 3.2) to the identified cycles, and determine whether the turning points (peaks) represent large bubbles, small bubbles, or non-bubbles. The identified bubbles are listed in Table I, II, III, and IV, while appendix Tables III, IV, V, and VI show the characteristics of all the price cycles.

We present analyses of the duration of house price upturns and downturns and study the price movements around peaks and troughs with two datasets for housing prices: one quarterly dataset from 1970 to 2015 for 20 OECD countries, and one yearly set with 6 countries and 2 cities (Australia, France, Norway, Sweden, UK, USA, Amsterdam and Paris), where 6 of the data series go back to the 1800s. As an example on how a descriptive bubble definition can be used to study house price phenomena's on large datasets, we also test and find that exponential growth rate in pre-peak house prices can be used as a bubble indicator.

The remainder of this paper is organized as follows. Data are described in the second section, followed by the empirical approach used to detect house price peaks and troughs. The empirical results are summarized in the fourth section, and section five concludes. The appendix tabulates the real and nominal price movements around the peaks and troughs for both datasets.

2. Data

We use two datasets with information on nominal and real house prices for several different countries, one of which covers the short quarterly development, and the other covers the long annual. The short dataset consists of observations spanning from the first quarter of 1970[1] to the last quarter of 2015. The set covers 20 countries with data from the Bank of International Settlement (BIS) for nominal housing prices, and we use inflation data from OECD to adjust to real prices. The long dataset consists of observations from 1850 to 2015[2]. We have eight data series based on official and commonly used sources for housing prices, and use the consumer price index to measure inflation and convert to real prices[3]. Stapledon (2012) provides the nominal and real house prices for Australia[4] for 1880–2011. For France and Paris, we have collected all data from the CGEDD[5]; the series span 1850 to 2010 and 1937 to 2010, respectively. We use the Herengracht index for housing prices in Amsterdam, produced by Eichholtz (1997) and extended by Ambrose, Eichholtz, and Lindenthal (2013). This index, and a consumer price index, are available through the Maastricht University, at which Eichholtz is a professor. Norges Bank makes available housing prices and CPI for 1819–2014, based on Eitrheim and Erlandsen (2004). Statistics Sweden provide the CPI and the

Swedish Riksbank offers data from Bohlin (2014) and Edvinsson, Blöndal, and Söderberg (2014) for Swedish[6] housing prices from 1875 to 2012. The shortest annual series is that for the UK, which spans 1930 to 2012, where both housing prices and CPI are collected from the Office for National Statistics. Shiller (2015) provides both nominal and real housing prices for the US, dating back to 1890. A more detailed account of the sources follows in Appendix Table I.

Houses differ in physical characteristics (size, rooms, etc.), location (city, proximity to jobs, etc.), and condition (decay, improvements, etc.). This paves the way for trade through bilateral negotiations, with only a small fraction of houses traded in any given quarter or year. Thus, the measurement of house prices becomes more complicated than pricing homogeneous goods traded in centralized markets. We try to ensure that indices are comparable by using reliable data from central banks, national statistics offices, research institutes, and academic studies. However, the underlying series can make use of different methodologies and cover limited geographical areas and types of dwellings. Although we use data from widely cited academic research and official national bureaus, the interpretation of results should consider this.

3. Empirical approach

3.1 Detect turning points

We use the Harding and Pagan (2002) algorithm to detect turning points in the two datasets, with a Stata code provided by Bracke (2013). There exists a number of different methods for identifying peaks, troughs, and bubbles. Interesting examples can be the Markoiv switching model suggested by Hamilton (1989), and the rolling windows GSADF Test for bubbles introduced by Phillips et. al. (2015). The Harding and Pagan (2002) algorithm has two advantages for our approach. Firstly, it is straightforward and easy to understand. Secondly, it simply divides the price series into upwards and downwards price cycles by identifying the respective peaks and troughs, for which serves as the basis of our analysis. This makes it possible for us to detect periods of rapid expansions and contractions. It was developed for the analysis of business cycles, but has been used to identify bull and bear markets by Pagan and Sossounov (2003), while Borio and McGuire (2004), Girouard et al. (2006), and Bracke (2013) use it for the housing market. This method identifies a series of local maxima and minima that segment the series into expansions and contractions. The algorithm considers the following three[7] constraints:

1. By using a window of *j* periods on each side, a local maximum p_t^+ is defined as an observation of the series such that $(y_{t-j}, \dots, y_{t-1}) < p_t^+ > (y_{t+1}, \dots, y_{t+j})$. Correspondingly a local minimum p_t^- satisfies $(y_{t-j}, \dots, y_{t-1}) > p_t^- < (y_{t+1}, \dots, y_{t+j})$. This identifies points that are higher or lower than a window of surrounding observations.

2. A local maximum must be followed by a local minimum, and vice versa. In cases of two consecutive maxima (minima), we choose the highest (lowest) p_t.

3. In order to reduce the series noise, the distance between two turning points has to be at least *q* periods.

The output is a series that gives the peaks and troughs in the data series denoted with 1 and -1, respectively. The algorithm requires a decision over the dimension for the rolling window (j) and the minimum phase length (q). Bracke (2013) analyzes the duration dependence of house price cycles, and sets $j = q = 6$, resulting in a rolling window of 13 quarters and a minimum phase of six quarters. This is supported by Borio and McGuire (2004) who identify significantly sizable housing price peaks by using a 13 quarter rolling window, and further by Girouard et al. (2006) who avoid the imputation of spurious house price cycles by imposing a minimum length of six quarters in a similar algorithm. For our short dataset, we follow these approaches. This indicates the use of parameters of either one or two years for our annual series: we consider one year to be too short and use $j = q = 2$ for the long dataset. Nevertheless, we use different rolling windows and phase lengths to ensure that results do not depend on a particular choice of parameters. Appendix Tables III, IV, V, and VI show the real and nominal price movements around all the identified peaks and trough, and Appendix Table II is a summary of the turning points in the short dataset.

3.2 Identifying bubbles

To create an interpretation of Lind's (2009) general definition for the housing market, we need to consider several aspects. First, we want to make the definition easy to use. Second, we want our definition to include house price cycles that normally have been thought of as bubbles, for example US, Ireland and Spain under the 2006-2008 financial crisis and Finland, Norway, and Sweden in the end of 1980s and early 1990s (Kindleberger and Aliber, 2005). Third, we want to set the threshold for what is considered a bubble high enough to not include normal house price cycles in the definition.

3.2.1 Dramatic price increase

We have chosen to include Lind's (2009) condition, where the price increase is measured over three and five years. Appendix Tables III and V show that the aggregated real five-year increase in the house prices covers the main share of the total aggregated price increase in periods with house price increase. There is also a question of how long a bubble can last—the situation is normally associated with mania, euphoria and mass hysteria (Kindleberger and Aliber, 2005). Our conclusion is that a five-year period is long enough to recognize bubbles.

A dramatic price increase has to be so large that a subsequent fall back to the previous level has to be regarded as a dramatic price fall. This price decrease should be severe enough to result in substantial financial or economic distress. To determine how to characterize a dramatic price increase, we look at the price increases that historically have occurred in the period before a dramatic price fall (Kindleberger and Aliber, 2005).

For a large housing bubble, a dramatic increase in real prices is at least 50% during a five-year period or 35% during a three-year period. Only one of these requirements needs to be met for a bubble to exist, either the five-year or the three-year price increase condition. A small bubble has a dramatic increase in real prices of at least 35% during a five-year period or 20% during a three-year period.

3.2.2 Almost immediate drop

Kindleberger and Aliber (2005) argue that, under the mania of a price bubble, when prices stop to grow they will start to fall immediate without an interphase, a plateau. We define large and small bubbles as having an aggregated fall in real prices of 35% and 20%,

respectively, but do not impose any direct requirements for an immediate fall in prices following the peak. The peaks are not required to be bigger than their surrounding observations by any exact magnitude, which leads to a possible stagnation in price increase prior to the peak and then a small gradual decrease after the peak. This is referred to as a price plateau. If the plateau lasts long enough, the price increase and subsequent decrease should be considered separate incidents, and not bubbles. Persistent plateaus are a possibility within our bubble definition, but they are unlikely. They can only occur in a way that allows for no new peaks or troughs, and furthermore, they must end in a greater aggregated price decrease. We agree with Lind (2009) that the peak can be considered a bubble if the plateau persists for less than one to two years.

3.2.3 Dramatic price fall

The interpretation of the definition is easy: it includes house price cycles that normally have been thought of as bubbles, and excludes normal cycles in the housing market. We add that the fall should be large enough that it could result in severe financial or economic crises. Lind's (2009) 50% fall seems too strict, leaving us with only five different bubbles in our two datasets, one of them during WWII. We set a lower threshold, and also divide the definition into large and small bubbles, defined by the development in real prices. It is desirable to include a small bubble definition in order to capture house price cycles that have the same properties as large bubbles, but with less dramatic price movements. In our definition, a large bubble has a dramatic fall in prices of at least 35%, and a small bubble has a dramatic fall of at least 20%.

3.2.4 Housing price bubble definition

We propose the following interpretations of Lind's bubble definition for the housing market:

> A large housing price bubble has a dramatic increase in real prices, at least 50% during a five-year period or 35% during a three-year period, followed by an immediate dramatic fall in the prices of at least 35%.
>
> A small housing price bubble has a dramatic increase in real price, at least 35% during a five-year period or 20% during a three-year period, followed by an immediate dramatic fall in the prices of at least 20%.

4. Results

We divide between two separate kinds of housing bubbles in the two different datasets, namely large and small bubbles.

Table I shows the large bubbles in the short datasets while Table II shows the large bubbles in the long dataset, they also give the price movements before and after the bubbles burst. For the short period we identify 9 large bubbles for 9 different countries, while we only find large bubbles for Amsterdam, Norway, Paris, and Sweden in the long dataset. This is not unexpected, considering that we have fewer observations in the annual series, and the difference in parameter requirements for identifying peaks. The peaks in the long series that occur after 1970 coincide with the peaks in the short series, except for Paris 1990, which does not show up in the data series for France. We see a tendency of accelerating price increases towards the peak, and furthermore, that price decreases generally continue beyond three years after the peak.

Table I. Large bubbles found among 20 OECD countries between 1970 and 2015.

Note: Quarterly real prices for 20 OECD countries from 1970–2015. Duration is the number of quarters since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration. * The aggregated price change is from the start of the period to the peak.

					Price change prior to/after peak				
Large (short)	**Price**	**Peaks/ Troughs**	**Dur.**	**Agg.**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year
Finland	Increase	1989-Q2	15	68.3 %	63.3 %	12.7 %	65.8 %	21.9 %	24.1 %
	Fall	1995-Q4	26	-50.5 %	-46.0 %	-9.2 %	-41.0 %	-13.7 %	-11.9 %
Ireland	Increase	2007-Q1	56	235.6 %	52.9 %	10.6 %	30.5 %	10.2 %	10.1 %
	Fall	2013-Q1	24	-53.6 %	-51.6 %	-10.3 %	-31.8 %	-10.6 %	-7.1 %
Netherlands	Increase	1978-Q2	33	138.9 %	94.4 %	18.9 %	69.0 %	23.0 %	6.5 %
	Fall	1985-Q3	29	-52.6 %	-47.9 %	-9.6 %	-35.5 %	-11.8 %	-11.8 %
New Zealand	Increase	1974-Q3	18	66.2 %	*66.2 %	14.7 %	64.4 %	21.5 %	29.9 %
	Fall	1980-Q4	25	-39.4 %	-34.7 %	-6.9 %	-22.7 %	-7.6 %	-9.2 %
Norway	Increase	1987-Q1	8	44.0 %	37.8 %	7.6 %	39.8 %	13.3 %	25.0 %
	Fall	1993-Q1	24	-45.5 %	-41.2 %	-8.2 %	-28.6 %	-9.5 %	-2.3 %
South Africa	Increase	1984-Q1	21	55.1 %	54.9 %	11.0 %	25.5 %	8.5 %	9.2 %
	Fall	1987-Q1	12	-44.1 %	-42.8 %	-8.6 %	-44.1 %	-14.7 %	-18.1 %
Spain	Increase	2007-Q2	41	138.8 %	69.2 %	13.8 %	30.1 %	10.0 %	9.0 %
	Fall	2014-Q1	27	-45.5 %	-36.0 %	-7.2 %	-14.1 %	-4.7 %	-4.5 %
UK	Increase	1973-Q3	14	67.4 %	*67.4 %	19.3 %	66.2 %	22.1 %	23.5 %
	Fall	1977-Q3	16	-35.6 %	-29.3 %	-5.9 %	-28.9 %	-9.6 %	-11.2 %
USA	Increase	2006-Q1	38	92.9 %	54.1 %	10.8 %	35.4 %	11.8 %	7.8 %
	Fall	2011-Q4	23	-39.6 %	-37.1 %	-7.4 %	-33.0 %	-11.0 %	-4.3 %

Table II. Large bubbles in the long dataset

Note: The long dataset consists of annual real prices for 6 countries and 2 cities, dating back to the 1800s. Duration is the number of years since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration.

					Price change prior to/after peak				
Large (long)	**Price**	**Peaks/ Troughs**	**Dur.**	**Agg.**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year
Amsterdam	Increase	1934	2	243.4 %	153.6 %	30.7 %	155.5 %	51.8 %	120.1 %
	Fall	1937	3	-74.7 %	-59.6 %	-11.9 %	-74.7 %	-24.9 %	-63.9 %
Amsterdam	Increase	1939	2	59.9 %	-59.6 %	-11.9 %	53.0 %	17.7 %	12.6 %
	Fall	1943	4	-54.8 %	-40.4 %	-8.1 %	-41.8 %	-13.9 %	-41.6 %
Amsterdam	Increase	1978	6	98.2 %	84.8 %	17.0 %	68.4 %	22.8 %	5.0 %
	Fall	1985	7	-50.7 %	-47.2 %	-9.4 %	-37.7 %	-12.6 %	-10.1 %
Norway	Increase	1859	9	70.5 %	60.9 %	12.2 %	53.1 %	17.7 %	18.7 %
	Fall	1868	9	-35.3 %	-32.2 %	-6.4 %	-29.9 %	-10.0 %	-25.1 %
Norway	Increase	1987	11	110.3 %	41.1 %	8.2 %	42.6 %	14.2 %	14.3 %
	Fall	1992	5	-44.5 %	-44.5 %	-8.9 %	-30.1 %	-10.0 %	-7.0 %

Paris	Increase	1990	6	114.4 %	104.5 %	20.9 %	64.6 %	21.5 %	14.2 %
	Fall	1997	7	-40.1 %	-29.9 %	-6.0 %	-21.5 %	-7.2 %	-1.6 %
Sweden	Increase	1990	6	74.0 %	70.3 %	14.1 %	40.1 %	13.4 %	8.7 %
	Fall	1993	3	-37.6 %	-35.5 %	-7.6 %	-37.6 %	-12.6 %	-9.2 %

The small bubbles are described in Table III and Table IV. Not surprisingly, there are more small bubbles for both the short and the long dataset. These have the same characteristics as the large bubbles, but with smaller aggregated price changes, and some have a shorter period with prices below the last peak. Before the peak we observe generally accelerating price increases, and after the peak we see that prices usually decrease for more than three years.

Table III. Small bubbles found among 20 OECD countries between 1970 and 2015.

Note: Quarterly real prices for 20 OECD countries from 1970–2015. Duration is the number of quarters since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration. * The aggregated price change is from the start of the period to the peak.

					Price change prior to/after peak				
Small (short)	**Price**	**Peaks/ Troughs**	**Dur.**	**Agg.**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year
Bergium	Increase	**1979-Q3**	31	59.6 %	33.4 %	6.7 %	21.2 %	7.1 %	3.9 %
	Fall	1985-Q2	23	-40.4 %	-36.8 %	-7.4 %	-26.5 %	-8.8 %	-7.1 %
Denmark	Increase	1986-Q2	14	55.8 %	29.9 %	6.0 %	31.5 %	10.5 %	14.0 %
	Fall	1993-Q2	28	-36.5 %	-29.4 %	-5.9 %	-19.2 %	-6.4 %	-12.5 %
Denmark	Increase	2006-Q3	53	180.1 %	63.9 %	12.8 %	60.0 %	20.0 %	21.1 %
	Fall	2012-Q4	25	-28.5 %	-25.0 %	-5.0 %	-21.1 %	-7.0 %	-0.7 %
Finland	Increase	1974-Q2	10	28.8 %	*27.9 %	6.6 %	28.5 %	9.5 %	6.8 %
	Fall	1979-Q3	21	-34.0 %	-33.8 %	-6.8 %	-26.6 %	-8.9 %	-13.5 %
Ireland	Increase	1980-Q4	43	44.3 %	44.3 %	8.9 %	29.2 %	9.7 %	5.8 %
	Fall	1987-Q2	26	-35.3 %	-29.0 %	-5.8 %	-25.7 %	-8.6 %	-7.0 %
Italy	Increase	1981-Q2	13	40.6 %	26.8 %	5.4 %	36.5 %	12.2 %	19.2 %
	Fall	1986-Q4	22	-27.8 %	-27.6 %	-5.5 %	-18.5 %	-6.2 %	-4.8 %
Japan	Increase	1973-Q4	15	60.9 %	*60.9 %	16.2 %	47.5 %	15.8 %	17.0 %
	Fall	1977-Q3	15	-34.2 %	-32.3 %	-6.5 %	-31.5 %	-10.5 %	-17.6 %
Japan	Increase	1990-Q4	53	79.6 %	37.6 %	7.5 %	22.9 %	7.6 %	9.7 %
	Fall	2009-Q2	74	-49.5 %	-17.3 %	-3.5 %	-14.3 %	-4.8 %	-3.3 %
Korea	Increase	1979-Q2	37	88.5 %	88.5 %	17.7 %	72.3 %	24.1 %	5.4 %
	Fall	1982-Q2	12	-33.6 %	-15.2 %	-3.0 %	-33.6 %	-11.2 %	-14.8 %
Korea	Increase	1991-Q1	14	34.3 %	27.0 %	5.4 %	25.7 %	8.6 %	8.1 %
	Fall	2001-Q1	40	-48.5 %	-33.0 %	-6.6 %	-25.8 %	-8.6 %	-11.6 %
Spain	Increase	1978-Q2	9	29.7 %	40.6 %	8.1 %	24.1 %	8.0 %	12.2 %
	Fall	1982-Q4	18	-36.7 %	-30.8 %	-6.2 %	-25.9 %	-8.6 %	-10.4 %
Spain	Increase	1991-Q4	36	142.3 %	102.4 %	20.5 %	34.2 %	11.4 %	10.9 %
	Fall	1997-Q1	21	-21.2 %	-21.0 %	-4.2 %	-18.7 %	-6.2 %	-12.5 %
Sweden	Increase	1990-Q1	17	46.6 %	42.5 %	8.5 %	35.9 %	12.0 %	8.8 %
	Fall	1995-Q4	23	-31.9 %	-30.0 %	-6.0 %	-28.4 %	-9.5 %	-1.6 %

Switzerland	Increase	1973-Q1	12	27.7 %	*27.7 %	9.2 %	27.7 %	9.2 %	17.7 %
	Fall	1976-Q3	14	-28.4 %	-26.6 %	-5.3 %	-27.8 %	-9.3 %	-10.6 %
Switzerland	Increase	1989-Q4	53	72.1 %	38.1 %	7.6 %	28.7 %	9.6 %	4.6 %
	Fall	2000-Q1	41	-38.6 %	-27.6 %	-5.5 %	-21.6 %	-7.2 %	-8.0 %
UK	Increase	1989-Q3	30	103.6 %	77.8 %	15.6 %	58.1 %	19.4 %	10.6 %
	Fall	1995-Q4	25	-29.3 %	-26.6 %	-5.3 %	-24.7 %	-8.2 %	-9.4 %

Table IV. Small bubbles in the long dataset.

Note: The long dataset consists of annual real prices for 6 countries and 2 cities, dating back to the 1800s. Duration is the number of years since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration.

					Price change prior to/after peak				
Small (long)	**Price**	**Peaks/ Troughs**	**Dur.**	**Agg.**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year
Amsterdam	Increase	1887	3	24.7 %	10.1 %	2.0 %	24.7 %	8.2 %	23.7 %
	Fall	1891	4	-33.4 %	-6.0 %	-1.2 %	-29.7 %	-9.9 %	-18.5 %
Amsterdam	Increase	1928	10	140.6 %	15.8 %	3.2 %	27.9 %	9.3 %	20.4 %
	Fall	1932	4	-28.5 %	11.6 %	2.3 %	-3.9 %	-1.3 %	-3.1 %
Amsterdam	Increase	1949	6	9.5 %	-17.0 %	-3.4 %	23.2 %	7.7 %	81.2 %
	Fall	1954	5	-62.4 %	-62.4 %	-12 5 %	-48.4 %	-16.1 %	-48.0 %
Australia	Increase	1889	6	42.5 %	23.3 %	4.7 %	21.3 %	7.1 %	14.3 %
	Fall	1894	5	-38.6 %	-38.6 %	-7.7 %	-10.2 %	-3.4 %	-7.0 %
Australia	Increase	1951	2	113.6 %	68.2 %	13.6 %	104.6 %	34.9 %	0.5 %
	Fall	1953	2	-27.3 %	-12.1 %	-2.4 %	-23.4 %	-7.8 %	-17.9 %
France	Increase	1943	2	42.4 %	-1.1 %	-0.2 %	28.1 %	9.4 %	25.1 %
	Fall	1948	5	-79.9 %	-79.9 %	-16.0 %	-58.4 %	-19.5 %	-4.1 %
Paris	Increase	1935	15	82.8 %	35.0 %	7.0 %	8.3 %	2.8 %	3.2 %
	Fall	1940	5	-50.4 %	-50.4 %	-10.1 %	-45.4 %	-15.1 %	-11.7 %
Sweden	Increase	1947	5	32.7 %	32.7 %	6.5 %	21.0 %	7.0 %	8.6 %
	Fall	1958	11	-32.5 %	-29.2 %	-5.8 %	-13.2 %	-4.4 %	-10.5 %
UK	Increase	1947	2	212.2 %	185.2 %	37.0 %	203.6 %	67.9 %	18.0 %
	Fall	1954	7	-26.1 %	-19.9 %	-4.0 %	-7.6 %	-2.5 %	-11.6 %
UK	Increase	1973	15	124.9 %	65.2 %	13.0 %	61.5 %	20.5 %	25.7 %
	Fall	1977	4	-34.4 %	-30.5 %	-6.1 %	-28.4 %	-9.5 %	-5.5 %
USA	Increase	2006	9	73.6 %	46.2 %	9.2 %	29.8 %	9.9 %	8.6 %
	Fall	2012	6	-35.1 %	-30.8 %	-6.2 %	-22.4 %	-7.5 %	-1.0 %

A summary of the average large bubbles, small bubbles, and non-bubble peaks is given in Table V. Most notably, we see clear differences between the price movements around the bubble and non-bubble peaks, and see the largest price increases and decreases within the large bubbles. Further, we see a tendency of accelerating price increases before the peaks. However, the results of the price change in the last year prior to the peak is not clear-cut, with the small bubbles showing decelerating price increases. This may indicate the presence of plateaus, which we discuss further in the next section.

Table V. Descriptive bubble statistics

Note: This table shows the average large and small bubble, as well as the average for the peaks we do not define as bubbles. The table covers both the short and long dataset. The short dataset consists of quarterly real prices for 20 OECD countries from 1970–2015. The long dataset consists of annual real prices for 6 countries and 2 cities, dating back to the 1800s.

				Price change prior to/after peak				
Short	**Price**	**Peaks/Troughs duration**	**Agg. Price change**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year
Large bubbles	Rise	6.8	100.8 %	62.2 %	13.3 %	47.4 %	15.8 %	16.1 %
	Fall	5.7	-45.2 %	-40.7 %	-8.1 %	-31.1 %	-10.4 %	-8.9 %
Small bubbles	Rise	6.9	68.4 %	48.1 %	10.2 %	36.5 %	12.2 %	11.0 %
	Fall	6.7	-34.6 %	-27.6 %	-5.5 %	-24.4 %	-8.1 %	-9.1 %
Rest	Rise	5.9	50.2 %	26.0 %	5.3 %	18.2 %	6.1 %	7.3 %
	Fall	3.8	-13.4 %	-2.9 %	-0.6 %	-7.6 %	-2.5 %	-4.7 %
Long								
Large bubbles	Rise	6.0	110.1 %	65.1 %	13.0 %	68.2 %	22.7 %	27.7 %
	Fall	5.4	-48.2 %	-41.3 %	-8.3 %	-39.0 %	-13.0 %	-22.6 %
Small bubbles	Rise	6.8	81.8 %	42.1 %	8.4 %	50.4 %	16.8 %	20.8 %
	Fall	5.3	-40.8 %	-31.7 %	-6.3 %	-26.5 %	-8.8 %	-12.6 %
Rest	Rise	6.9	87.8 %	17.5 %	3.5 %	12.6 %	4.2 %	7.2 %
	Fall	5.3	-20.3 %	-13.7 %	-2.8 %	-13.3 %	-4.4 %	-6.8 %

To exemplify the use of a descriptive bubble definition, we create and test a new bubble indicator (Table VI). The exponential growth rate (EGR) method posits that a faster than exponential rate of growth in house prices is unsustainable and evidence of a bubble. Sornette and his colleagues apply this method in several studies, including Zhou and Sornette (2006), and find that 22 U.S. states had bubbles at the end of the 1993–2005 period.

Our indicator consists of two trials for the identified peaks that ask the following: is the three-year annual average larger than 10%? Is the three-year annual average larger than the five-year annual average? This sets a minimum price increase in the short time prior to the peak, and requires the price increase to be accelerating. The possible presence of a price plateau immediately before the peak makes it undesirable to look at the last year's price movements. For the peaks that we do not define as bubbles, few have an annual three-year average above 10%, and just above half have a larger three-year than five-year average. We expect the criteria to be fulfilled most frequently for our large bubbles, but also to be common for the small bubbles. These expectations are generally observed in our data, though only 67% of the large bubbles in our short dataset have an accelerating price increase prior to the burst. However, if both criteria are fulfilled, we see a clear difference between large bubbles, small bubbles, and the rest of the peaks, in accordance with our expectations.

Table VI. Bubble indicator preformance

Note: The first three columns of this table show the count of peaks that have a three-year annual average larger than 10%, a three-year annual average larger than its five-year annual average, and both (indicator). The next column shows the proportion of cycles with at least one occurance of the indicator that end in large bubbles, small bubbles, and non-bubble peaks. The last two columns show the average number of years between the first time the indicator occurs and the cycle peak, and

between the last time it occures and the cycle peak. Lastly, the table shows the two datasets total number of cycles with increasing real prices, and the number of these cycles with the indicator occuring at least once. The short dataset consists of quarterly real prices for 20 OECD countries from 1970–2015. The long dataset consists of annual real prices for 6 countries and 2 cities, dating back to the 1800s.

Dataset	Peak	An. Average for 3 year agg. > 10%	3 year an. Average > 5 year an. average	Indicator (both)	Indicator occurs at least once in cycle	Average number of years from first to top	Average number of years from last to top
Short	Large bubble	8 / 9 (89%)	6 / 9 (67%)	6 / 9 (67%)	7 / 28 (25%)	3.04	0.39
	Small bubble	8 / 16 (50%)	12 / 16 (75%)	6 / 16 (38%)	8 / 28 (29%)	1.50	0.44
	Non-bubble	8 / 49 (16%)	28 / 49 (57%)	6 / 49 (12%)	13 / 28 (46%)	4.13	1.69
	Cycles (total)			74	28		
Long	Large bubble	7 / 7 (100%)	6 / 7 (86%)	6 / 7 (86%)	6 / 27 (22%)	1.00	0.00
	Small bubble	5 / 11 (45%)	10 / 11 (91%)	5 / 11 (45%)	5 / 27 (19%)	3.20	0.80
	Non-bubble	6 / 65 (9%)	38 / 65 (58%)	3 / 65 (5%)	16 / 27 (59%)	6.81	3.50
	Cycles (total)			83	27		

5. Conclusion

Housing price bubbles are quite rear. For our short series, we have an average of about one large bubble every 100 years, while our long series shows an average close to 170 years. The small bubbles are more frequent, with the small and long dataset averaging a bubble around every 50 and 100 years, respectively. On average, the short dataset shows either a large or small bubble every 36 years, while for the long dataset this is every 65 years.

Bubbles that have slow growth over a long time period, like the ones in Ireland 2007 and Spain 2007, seem to be the exception. It appears that most of the bubbles are short and intensive. Table I through IV and Appendix Tables III and V show that the aggregated real five-year increase in the house prices covers the main share of the total aggregated price increase in periods with house price increase. For many of the bubbles the intensive growth period before the peak is shorter than five years. Also the fall in house prices after the bubble peak is short and intensive, whit the exception of Japan 1990, the first five years after the bubble peak constitutes almost the entire drop in real house prices.

One condition that neither Lind (2009) nor we have included is whether a bubble can exist without also a dramatic fall, or at least a fall, in nominal house prices. If we consider Kindleberger's (1987) definition, would a situation without a fall in nominal house prices result in severe financial or economic crises? In periods with high inflation, it is possible to have a dramatic fall in real prices with only a small or no fall in nominal house prices. We have examples of this among our bubbles: UK 1973-Q3 in our short dataset, and New Zealand 1974-Q3 among our large bubbles. The UK peak coincides with the peak before the UK's 1973–75 banking crisis (Reid, 1982). Also, the New Zealand peak came before a period of economic crises, low growth and increased unemployment. Among our large bubbles in the long dataset, all had a nominal fall in the house prices after the peak.

We propose the following interpretations of Lind's bubble definition for the housing market:

A large house price bubble involves a dramatic increase in real prices, of at least 50% during a five-year period or 35% during a three-year period, followed by an immediate dramatic fall in the prices of at least 35%. A small house price bubble involves a dramatic increase in real prices, of at least 35% during a five-year period or 20% during a three-year period, followed by an immediate dramatic fall in the prices of at least 20%.

By identifying real price peaks, determining the three-year annual average price increase, and measuring if it grows exponentially, we can give an indication to whether a bubble is present or not. We see clear differences between large bubbles, small bubbles, and non-bubble peaks when we measure if the three-year annual average is at least 10% and bigger than the five-year annual average, and propose this as our bubble indicator.

Notes

1. Spain, Ireland, Italy, and Korea start in the third quarter of 1971, the second quarter of 1976, the third quarter of 1970, and the first quarter of 1975, respectively.
2. Australia 1880–2011, France 1936–2010, Paris 1850–2010, Netherlands 1850–2010, Norway 1850–2014, Sweden 1875–2012, UK 1930–2010, USA 1890–2015.
3. For Australia and USA, both the nominal and real prices come directly from the source.
4. Australia consists of the average of Sidney and Melbourne.
5. Le conseil général de l'Environnement et du Développement durable.
6. Sweden consists of the average of Stockholm and Gothenburg.
7. Additionally, one can impose a minimum distance between two consecutive maxima (minima) of k periods. We consider this constraint redundant for the identification of housing price cycles.

References

Ambrose, B. W., Eichholtz, P. and Lindenthal, T. (2013), "House prices and fundamentals: 355 years of evidence", *Journal of Money, Credit and Banking*, Vol. 45 No. 2-3, pp. 477–491.

Angnello, L. and Schukneckt, L. (2011), "Booms and bust in housing markets: Determinants and implications", European Central Bank Working paper series No. 1071.

André, C. (2010), "A Bird's Eye View of OECD Housing Market", OECD Economics Department Working Papers, No. 746, OECD Publishing, Paris.

Bohlin, J. (2014), "A Price Index for Residential Property in Göteborg, 1875–2010", Edvinsson, R., Jacobson, T. and Waldenström, D. (Eds.), *Historical Monetary and Financial Statistics for Sweden: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620-2012*, Ekerlids Förlag, Stockholm, Sweden, pp. 26–62.

Borio, C. E. and McGuire, P. (2004), "Twin peaks in equity and housing prices", Bisignano, J., Borio, C., McCauley, R., Remolona, E., Turner, P., Van den Bergh, P. and White, W. (Eds.), B*IS Quarterly Review, March*, Bank for International Settlements, Basel, Switzerland, pp. 79–93.

Bracke, P. (2013), "How long do housing cycles last? A duration analysis for 19 OECD countries", *Journal of Housing Economics*, Vol. 22 No. 3, pp. 213–230.

Brunnermeier, M. K, og Schnabel, I (2015). Bubbles and Central Banks: Historical Perspectives. Central Banks at a Crossroads: What Can We Learn from History?. Cambridge, UK: Cambridge University Press, 2016. Web.

Cochrane, J. H. (2010), "Discount Rates", Working paper, University of Chicago, Booth School of Business, and NBER, Chicago, Illinois, 27 December.

DiPasquale, D. and Wheaton, W.C. (1994), "Housing market dynamics and the future of housing prices", *Journal of Urban Economics*, Vol. 35 No. 1, pp. 1–27.

Edvinsson, R., Blöndal, S. and Söderberg, J. (2014), "A price index for residential property in Stockholm, 1875–2011", Edvinsson, R., Jacobson, T. and Waldenström, D. (Eds.), *Historical Monetary and Financial Statistics for Sweden: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620-2012*, Ekerlids Förlag, Stockholm, Sweden, pp. 63–100.

Eichholtz, P. (1997), "A long run house price index: The Herengracht index, 1628–1973", *Real estate economics*, Vol. 25 No. 2, pp. 175–192.

Eitrheim, Ø. and Erlandsen, S. K. (2004), "House price indices for Norway 1819–2003", Eitrheim, Ø., Klovland, J. T. and Qvigstad, J. F. (Eds.), *Historical monetary statistics for Norway 1819-2003*, Norges Bank, Oslo, Norway, pp. 349–376.

Flood, R. P. and Hodrick, R. J. (1990), "On Testing for Speculative Bubbles", *The Journal of Economic Perspectives*, Vol. 4 No. 2, pp. 85–101.

Girouard, N., Kennedy, M., Van den Noord, P. and André, C. (2006), "Recent house price developments: The Role of Fundamentals", working paper No. 475, OECD Economics Department, Paris, France, 23 January.

Harding, D. and Pagan, A. (2002), "Dissecting the cycle: a methodological investigation", *Journal of monetary economics*, Vol. 49 No. 2, pp. 365–381.

Kindleberger, C. (1987), "Bubbles, Eatwell, J., Milgate, M. and Newman", P. (Eds.), *The New Palgrave: A Dictionary of Economics*, Stockton Press, New York, New York, p. 281.

Kindleberger, C. and R. Aliber, R. (2005), "Manias, Panics and Crashes –A History of Financial Crises", John Wiley and Sons, Hoboken, NJ.

Lind, H. (2009), "Price bubbles in housing markets: Concept, theory and indicators", *International Journal of Housing Markets Analysis*, Vol. 2 No. 1, pp. 78-90.

Pagan, A. R. and Sossounov, K. A. (2003), "A simple framework for analysing bull and bear markets", *Journal of Applied Econometrics*, Vol. 18 No. 1, pp. 23–46.

Palgrave, R.H. I. (1926), "Palgrave's Dictionary of Political Economy", MacMillan & Co., London, England, p. 181.

Reid, M. (1982), "*The Secondary Banking Crisis, 1973–75: Its Causes and Course*", Macmillan, London, England.

Shiller, R. J. (2015), "*Irrational exuberance*", Princeton university press, Princeton, NJ.

Smith, M. H. and Smith, G. (2006), "Bubble, Bubble, Where's the Housing Bubble?", *Brookings Papers on Economic Activity*, Vol. 2006 No. 1, pp. 1–50.

Stapledon, N. (2012), "Trends and Cycles in S ydney and M elbourne House Prices from 1880 to 2011", *Australian Economic History Review*, Vol. 52 No. 3, pp. 293–317.

Stiglitz, J.E. (1990), "Symposium on bubbles", *The Journal of Economic Perspectives*, Vol. 4 No. 2, pp. 13–18.

Zhou, W. and Sornette, D. (2006), "Is There a Real Estate Bubble in the US?", *Physica A: Statistical Mechanics and its Applications*, Vol. 361 No. 1, pp. 297–308.

Appendix

Appendix Table I. Complete list of sources

Note: This table gives a complete list of the short and long datasets used in this article. The short dataset consists of quarterly nominal and real prices for 20 OECD countries from 1970–2015. The long dataset consists of annual nominal and real prices for 6 countries and 2 cities, dating back to the 1800s.

Series	Data	Start	End	Our source	Other source (if any)
Short-All	Nominal	1970	2015	Bank of international settlement ("PP-long") Downloadable: http://www.bis.org/statistics/pp_long.htm	
Short-All	Inflation	1970	2015	OECD (total) Downloadable: https://data.oecd.org/price/inflation-cpi.htm	
Long					
Australia	Real/Nominal	1800	2011	Stapledon, N. (2012). "Trends and Cycles in Sydney and Melbourne House Prices from 1880 to 2011"	
France	Nominal	1840	2010	CGEDD	National Institute of Statistics and Economic Studies
	CPI	1800	2010	CGEDD Downloadable: http://www.cgedd.developpement-durable.gouv.fr/prix-immobilier-evolution-a-long-terme-a1048.html	http://www.insee.fr/en/default.asp
Paris	Nominal	1937	2010	CGEDD	National Institute of Statistics and Economic Studies
	CPI	1800	2010	CGEDD Downloadable: http://www.cgedd.developpement-durable.gouv.fr/prix-immobilier-evolution-a-long-terme-a1048.html	http://www.insee.fr/en/default.asp
Amsterdam	Nominal	1650	2010	Maastricht University (Eichholtz) [Includes CPI] Downloadable: http://www.maastrichtuniversity.nl/web/Main/Sitewide/Content/EichholtzPiet.htm	Ambrose et. al. (2013). "House prices and fundamentals: 355 years of evidence"
Norway	Nominal	1819	2014	Norges Bank Downloadable: http://www.norges-bank.no/en/Statistics/Historical-monetary-statistics/House-price-indices/	Eitrheim, Ø. and S. Erlandsen (2004). "House price indices for Norway 1819-2003", 349-376. Chapter 9 in Eitrheim, Ø., J.T. Klovland and J.F. Qvigstad (eds.), Historical Monetary Statistics for Norway 1819-2003
	CPI	1777	2015	Norges Bank Downloadable: http://www.norges-bank.no/en/Statistics/Historical-monetary-statistics/Consumer-price-indices/	Grytten, O.H. (2004). "A consumer price index for Norway 1516-2003", 47-98, Chapter 3 in Eitrheim, Ø., J.T. Klovland and J.F. Qvigstad (eds.), Historical Monetary Statistics for Norway 1819-2003
Sweden	Nominal	1875	2012	Swedish Riksbank Downloadable: http://www.riksbank.se/en/Search/?query=price+index+for+residential+property	Jan Bohlin (2014), 'A price index for residential property in Göteborg, 1875–2010', in Historical Monetary and Financial Statistics for Sweden, Volume II: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620–2012 (eds. Rodney Edvinsson, Tor Jacobson and Daniel Waldenström) Sveriges Riksbank and Ekerlids.

					Johan Söderberg, Sölvi Blöndal, and Rodney Edvinsson (2014), 'A price index for residential property in Stockholm, 1875–2011', in Historical Monetary and Financial Statistics for Sweden, Volume II: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620–2012 (eds. Rodney Edvinsson, Tor Jacobson and Daniel Waldenström) Sveriges Riksbank and Ekerlids.
	CPI	1830	2015	Statistics Sweden Downloadable: http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Prices-and-Consumption/Consumer-Price-Index/Consumer-Price-Index-CPI/Aktuell-Pong/33779/Consumer-Price-Index-CPI/33895/	
UK	Nominal	1930	2010	Office for National Statistics Downloadable: http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=House+Price+Indices	1930-1938: taken from Table A.13, page 128 of "House Prices: Changes Through Time at National and Sub-National Level", Government Economic Service, Working Paper No 110. 1939 - 1945: no reliable information available. 1946 to 1952: a house price index for modern, existing dwellings was calculated by the Co-operative Building Society from 1946 (=100) to 1970. The movements in the index from 1946 to 1953 have been applied to the average 1953 price of 1953 to 1955: derived from the average of two series of UK projected house prices. 1956 to 1965: prices are based on the BS4 survey of mortgage completions for NEW dwellings. No adjustment has been made to allow for the absence of existing dwellings. Whilst in recent years average prices of new dwellings have often been more than 10 per cent higher than the average for all dwellings, this was not the situation from 1966 to 1974, the first years when BS4 data both for new and all dwellings was available. 1966 to 1992: average prices are based on the 5 per cent survey of building societies. From 1969 the mix-adjusted 1993 to 2002: average prices and the mix-adjusted index are based on the five per cent Survey of Mortgage Lenders. 2003 - Aug 2005: average prices and the mix-adjusted index remain based on the Survey of Mortgage Lenders, but from a significantly larger sample size. Sept 2005 to date: collected from the Regulated Mortgage Survey (CML).
	CPI	1800	2015	Office for National Statistics Downloadable: http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?cdid=CDKO&dataset=mm23&table-id=3.5	
USA	Real/Nominal	1890	2015	Yale University (Shiller). Downloadable: http://www.econ.yale.edu/~shiller/data.htm	Robert J. Shiller, Irrational Exuberance, 3rd. Edition, Princeton University Press, 2015

Appendix Table II. Summary and descriptive statistics for the turning points in the short dataset

Note: This table shows the summary and descriptive statistics for the peaks and troughs in the short dataset. The short dataset consists of quarterly nominal and real prices for 20 OECD countries from 1970–2015.The turning points are identified using an algorithm described in section 4.

	Number	Average duration (quarters)	Maximum duration (quarters)	Average price change (Real)	Largest price change (Real)	Number of turns > 20% (Real)	Average price change (Nominal)	Largest price change (Nominal)	Number of turns > 20% (Nominal)
Peaks									
Australia	7	15.0	31	31.8 %	83.2 %	4	55.6 %	118.9 %	6
Belgium	3	43.3	90	81.8 %	181.6 %	2	179.8 %	345.0 %	2
Canada	4	16.3	27	33.5 %	70.2 %	2	70.7 %	129.6 %	3
Denmark	4	22.8	53	68.3 %	180.1 %	3	112.9 %	269.2 %	4
Finland	5	19.6	46	49.5 %	99.9 %	4	83.5 %	133.9 %	4
France	4	29.0	43	51.5 %	120.4 %	3	121.7 %	254.0 %	3
Germany	3	14.3	19	9.8 %	17.5 %	0	29.1 %	42.7 %	2
Ireland	3	37.3	56	104.1 %	235.6 %	3	201.1 %	402.4 %	3
Italy	4	22.3	34	49.1 %	61.4 %	4	109.8 %	129.6 %	4
Japan	3	28.3	53	48.6 %	79.6 %	2	90.0 %	155.2 %	2
Korea	4	23.8	37	49.2 %	88.5 %	4	110.3 %	249.8 %	4
Netherlands	2	61.0	89	179.5 %	220.2 %	2	360.6 %	387.8 %	2
New Zealand	5	18.4	25	47.8 %	89.9 %	4	90.3 %	140.7 %	5
Norway	3	30.0	57	102.0 %	205.1 %	3	179.9 %	300.0 %	3
South Africa	4	22.8	42	70.8 %	211.0 %	2	180.0 %	417.3 %	4
Spain	4	25.8	41	85.3 %	142.3 %	4	190.8 %	367.5 %	4
Sweden	2	27.5	38	37.0 %	46.6 %	2	131.3 %	180.6 %	2
Switzerland	2	32.5	53	49.9 %	72.1 %	2	102.2 %	151.8 %	2
UK	4	25.3	47	94.7 %	175.3 %	4	153.9 %	233.2 %	4
USA	4	23.3	38	42.4 %	92.9 %	3	78.3 %	143.0 %	4
Average	3.7	26.9	46.0	64.3 %	123.7 %	2.9	131.6 %	227.6 %	3.4
Troughs									

Australia	7	8.9	18	-10.1 %	-16.8 %	0	8.3 %	-4.7 %	0
Belgium	3	12.0	23	-17.6 %	-40.4 %	1	-3.7 %	-10.1 %	0
Canada	4	12.3	18	-15.2 %	-23.9 %	1	-1.1 %	-5.9 %	0
Denmark	4	20.0	28	-27.3 %	-38.3 %	3	-2.5 %	-19.3 %	0
Finland	5	13.4	26	-19.8 %	-50.5 %	2	-0.8 %	-39.1 %	1
France	3	16.7	22	-16.6 %	-21.3 %	1	3.9 %	-8.8 %	0
Germany	3	39.0	70	-14.6 %	-27.8 %	1	7.7 %	3.1 %	0
Ireland	3	20.0	26	-31.7 %	-53.6 %	2	-9.4 %	-50.7 %	1
Italy	3	20.3	25	-17.3 %	-27.8 %	1	31.7 %	9.1 %	0
Japan	2	44.5	74	-41.9 %	-49.5 %	2	-19.1 %	-46.0 %	1
Korea	4	19.5	40	-23.2 %	-48.5 %	2	3.8 %	-15.1 %	0
Netherlands	2	26.5	29	-40.9 %	-52.6 %	2	-26.3 %	-33.2 %	1
New Zealand	5	14.6	25	-15.2 %	-39.4 %	1	14.4 %	-3.8 %	0
Norway	4	16.3	24	-21.4 %	-45.5 %	2	3.0 %	-28.5 %	1
South Africa	4	19.5	27	-27.9 %	-44.1 %	3	21.8 %	-9.9 %	0
Spain	4	18.3	27	-29.2 %	-45.5 %	3	-0.1 %	-36.2 %	1
Sweden	2	24.0	25	-35.8 %	-39.8 %	2	-0.3 %	-9.0 %	0
Switzerland	2	27.5	41	-33.5 %	-38.6 %	2	-15.6 %	-21.9 %	1
UK	4	17.8	25	-25.1 %	-35.6 %	2	6.5 %	-8.2 %	0
USA	4	18.5	29	-17.9 %	-39.6 %	1	3.9 %	-30.5 %	1
Average	3.6	20.5	31.1	-24.1 %	-38.9 %	1.7	1.3 %	-18.4 %	0.4

Appendix Table III. Real prices for the peaks and troughs in the short dataset

Note: This table shows the changes in real prices around all the identified peaks and troughs in the short dataset. The short dataset consists of quarterly real prices for 20 OECD countries from 1970–2015.The turning points are identified using an algorithm described in section 4. Duration is the number of quarters since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration. Quarters below peak shows the number of quarters before real prices rise to the last peak again.

*Shows the aggregated price change from the start of the period to the peak.

¤Shows the aggregated price change from the peak to the end of the period.

				Price change prior to peak					Price change after peak							
	Peaks	**Dur.**	**Agg. Price change**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year	1 year	Agg. 3 year	An. 3Y average	Agg. 5 year	An. 5Y average	**Troughs**	**Dur.**	**Agg. Price change**
Australia	1974-Q2	17	39.5 %	39.5 % *	9.3 %	30.6 %	10.2 %	12.0 %	-6.7 %	-11.6 %	-3.9 %	-10.4 %	-2.1 %	1978-Q4	18	-16.8 %
	1981-Q2	10	16.9 %	5.0 %	1.0 %	14.5 %	4.8 %	7.2 %	-5.6 %	-8.8 %	-2.9 %	-3.8 %	-0.8 %	1983-Q3	9	-14.5 %
	1985-Q1	6	13.2 %	7.0 %	1.4 %	3.7 %	1.2 %	9.2 %	-1.1 %	-3.3 %	-1.1 %	18.3 %	3.7 %	1987-Q2	9	-8.8 %
	1989-Q2	8	37.6 %	33.2 %	6.6 %	26.2 %	8.7 %	25.1 %	-6.6 %	-9.4 %	-3.1 %	-6.4 %	-1.3 %	1991-Q1	7	-11.5 %
	1994-Q3	14	6.7 %	-3.1 %	-0.6 %	2.3 %	0.8 %	3.0 %	-4.4 %	-2.4 %	-0.8 %	10.3 %	2.1 %	1996-Q1	6	-6.6 %
	2003-Q4	31	83.2 %	62.9 %	12.6 %	50.7 %	16.9 %	16.0 %	-2.0 %	1.7 %	0.6 %	3.4 %	0.7 %	2005-Q3	7	-3.6 %
	2010-Q2	19	25.6 %	24.6 %	4.9 %	12.8 %	4.3 %	12.4 %	-5.3 %	-5.8 %	-1.9 %	9.2 %	1.8 %	2011-Q4	6	-9.2 %
Belgium														1971-Q4	7	-9.1 %
	1979-Q3	31	59.6 %	33.4 %	6.7 %	21.2 %	7.1 %	3.9 %	-7.1 %	-26.5 %	-8.8 %	-36.8 %	-7.4 %	1985-Q2	23	-40.4 %
	2007-Q4	90	181.6 %	39.5 %	7.9 %	23.5 %	7.8 %	5.4 %	-2.2 %	0.1 %	0.0 %	-1.6 %	-0.3 %	2009-Q2	6	-3.5 %
	2011-Q3	9	4.1 %	6.3 %	1.3 %	1.3 %	0.4 %	0.8 %	-1.0 %	-2.2 %	-0.7 %	-0.5 % ¤	-0.1 %			
Canada	1976-Q4	27	47.1 %	40.3 %	8.1 %	12.2 %	4.1 %	2.9 %	-4.4 %	-5.3 %	-1.8 %	-3.2 %	-0.6 %	1978-Q3	7	-8.2 %
	1981-Q1	10	10.5 %	2.1 %	0.4 %	8.7 %	2.9 %	8.0 %	-10.8 %	-21.4 %	-7.1 %	-15.6 %	-3.1 %	1984-Q3	14	-23.9 %
	1989-Q1	18	70.2 %	64.6 %	12.9 %	53.4 %	17.8 %	18.1 %	-7.8 %	-16.0 %	-5.3 %	-12.7 %	-2.5 %	1991-Q3	10	-18.0 %
	1994-Q1	10	6.4 %	-12.7 %	-2.5 %	0.3 %	0.1 %	1.6 %	-3.9 %	-7.8 %	-2.6 %	-9.4 %	-1.9 %	1998-Q3	18	-10.9 %
Denmark	1973-Q4	15	23.6 %	23.6 % *	6.3 %	31.0 %	10.3 %	5.8 %	-10.2 %	-2.5 %	-0.8 %	4.0 %	0.8 %	1977-Q1	13	-5.8 %
	1979-Q2	9	13.9 %	20.2 %	4.0 %	10.6 %	3.5 %	3.8 %	-15.3 %	-35.2 %	-11.7 %	-22.5 %	-4.5 %	1982-Q4	14	-38.3 %
	1986-Q2	14	55.8 %	29.9 %	6.0 %	31.5 %	10.5 %	14.0 %	-12.5 %	-19.2 %	-6.4 %	-29.4 %	-5.9 %	1993-Q2	28	-36.5 %
	2006-Q3	53	180.1 %	63.9 %	12.8 %	60.0 %	20.0 %	21.1 %	-0.7 %	-21.1 %	-7.0 %	-25.0 %	-5.0 %	2012-Q4	25	-28.5 %
Finland														1971-Q4	7	-0.7 %
	1974-Q2	10	28.8 %	27.9 % *	6.6 %	28.5 %	9.5 %	6.8 %	-13.5 %	-26.6 %	-8.9 %	-33.8 %	-6.8 %	1979-Q3	21	-34.0 %

	1984-Q1	18	36.6 %	35.2 %		7.0 %	27.6 %	9.2 %	6.3 %	-0.2 %	1.8 %	0.6 %	61.3 %	12.3 %	1985-Q3	6	-4.1 %
	1989-Q2	15	68.3 %	63.3 %		12.7 %	65.8 %	21.9 %	24.1 %	-11.9 %	-41.0 %	-13.7 %	-46.0 %	-9.2 %	1995-Q4	26	-50.5 %
	2007-Q2	46	99.9 %	30.1 %		6.0 %	15.4 %	5.1 %	3.6 %	-1.1 %	2.1 %	0.7 %	2.1 %	0.4 %	2009-Q1	7	-9.5 %
	2011-Q2	9	13.9 %	6.8 %		1.4 %	4.2 %	1.4 %	1.0 %	-1.0 %	-3.0 %	-1.0 %	-3.5 % ¤	-0.8 %			
France	1980-Q3	42	39.6 %	25.6 %		5.1 %	12.2 %	4.1 %	6.7 %	-3.1 %	-13.7 %	-4.6 %	-19.8 %	-4.0 %	1986-Q1	22	-21.3 %
	1991-Q3	22	36.2 %	30.7 %		6.1 %	15.4 %	5.1 %	1.4 %	-6.1 %	-10.4 %	-3.5 %	-13.9 %	-2.8 %	1997-Q1	22	-18.0 %
	2007-Q4	43	120.4 %	59.5 %		11.9 %	27.1 %	9.0 %	4.2 %	-6.6 %	-4.3 %	-1.4 %	-6.7 %	-1.3 %	2009-Q2	6	-10.5 %
	2011-Q3	9	9.6 %	2.9 %		0.6 %	1.2 %	0.4 %	3.8 %	-3.4 %	-8.0 %	-2.7 %	-9.6 % ¤	-2.3 %			
Germany	1974-Q2	17	11.4 %	11.4 %	*	2.7 %	2.4 %	0.8 %	0.1 %	-4.5 %	-6.9 %	-2.3 %	4.2 %	0.8 %	1976-Q3	9	-8.5 %
	1981-Q2	19	17.5 %	17.0 %		3.4 %	12.2 %	4.1 %	1.4 %	-4.5 %	-13.0 %	-4.3 %	-15.5 %	-3.1 %	1998-Q4	70	-27.8 %
	2000-Q3	7	0.6 %	-7.1 %		-1.4 %	-1.5 %	-0.5 %	0.5 %	-1.3 %	-3.6 %	-1.2 %	-1.8 %	-0.4 %	2010-Q1	38	-7.5 %
Ireland	1980-Q4	43	44.3 %	44.3 %		8.9 %	29.2 %	9.7 %	5.8 %	-7.0 %	-25.7 %	-8.6 %	-29.0 %	-5.8 %	1987-Q2	26	-35.3 %
	1990-Q3	13	32.5 %	21.9 %		4.4 %	24.8 %	8.3 %	10.2 %	-3.1 %	-1.5 %	-0.5 %	1.6 %	0.3 %	1993-Q1	10	-6.3 %
	2007-Q1	56	235.6 %	52.9 %		10.6 %	30.5 %	10.2 %	10.1 %	-7.1 %	-31.8 %	-10.6 %	-51.6 %	-10.3 %	2013-Q1	24	-53.6 %
Italy	1974-Q3	18	55.2 %	55.2 %	*	12.3 %	53.0 %	17.7 %	33.7 %	-5.1 %	-10.7 %	-3.6 %	-3.1 %	-0.6 %	1978-Q1	14	-12.0 %
	1981-Q2	13	40.6 %	26.8 %		5.4 %	36.5 %	12.2 %	19.2 %	-4.8 %	-18.5 %	-6.2 %	-27.6 %	-5.5 %	1986-Q4	22	-27.8 %
	1992-Q4	24	61.4 %	56.7 %		11.3 %	27.0 %	9.0 %	8.8 %	-2.9 %	-10.5 %	-3.5 %	-9.9 %	-2.0 %	1999-Q1	25	-12.2 %
	2007-Q3	34	39.3 %	21.2 %		4.2 %	12.5 %	4.2 %	3.0 %	-0.9 %	-5.6 %	-1.9 %	-13.6 %	-2.7 %			
Japan	1973-Q4	15	60.9 %	60.9 %	*	16.2 %	47.5 %	15.8 %	17.0 %	-17.6 %	-31.5 %	-10.5 %	-32.3 %	-6.5 %	1977-Q3	15	-34.2 %
	1990-Q4	53	79.6 %	37.6 %		7.5 %	22.9 %	7.6 %	9.7 %	-3.3 %	-14.3 %	-4.8 %	-17.3 %	-3.5 %	2009-Q2	74	-49.5 %
	2013-Q3	17	5.3 %	1.6 %		0.3 %	1.7 %	0.6 %	2.8 %	-2.4 %	-1.5 % ¤	-0.7 %	-1.5 % ¤	-0.7 %			
Korea	1979-Q2	37	88.5 %	88.5 %		17.7 %	72.3 %	24.1 %	5.4 %	-14.8 %	-33.6 %	-11.2 %	-15.2 %	-3.0 %	1982-Q2	12	-33.6 %
	1986-Q1	15	43.8 %	28.6 %		5.7 %	28.8 %	9.6 %	8.5 %	-4.4 %	7.7 %	2.6 %	27.0 %	5.4 %	1987-Q3	6	-5.5 %
	1991-Q1	14	34.3 %	27.0 %		5.4 %	25.7 %	8.6 %	8.1 %	-11.6 %	-25.8 %	-8.6 %	-33.0 %	-6.6 %	2001-Q1	40	-48.5 %
	2008-Q2	29	30.0 %	6.9 %		1.4 %	12.1 %	4.0 %	0.6 %	-4.3 %	-3.3 %	-1.1 %	-5.0 %	-1.0 %	2013-Q2	20	-5.0 %
Netherlands	1978-Q2	33	138.9 %	94.4 %		18.9 %	69.0 %	23.0 %	6.5 %	-11.8 %	-35.5 %	-11.8 %	-47.9 %	-9.6 %	1985-Q3	29	-52.6 %
	2007-Q4	89	220.2 %	14.8 %		3.0 %	9.6 %	3.2 %	3.9 %	-3.6 %	-10.8 %	-3.6 %	-23.9 %	-4.8 %	2013-Q4	24	-29.2 %
New Z.land	1974-Q3	18	66.2 %	66.2 %	*	14.7 %	64.4 %	21.5 %	29.9 %	-9.2 %	-22.7 %	-7.6 %	-34.7 %	-6.9 %	1980-Q4	25	-39.4 %
	1985-Q1	17	33.0 %	30.4 %		6.1 %	11.0 %	3.7 %	3.4 %	-1.6 %	0.4 %	0.1 %	2.2 %	0.4 %	1987-Q1	8	-7.3 %
	1989-Q3	10	11.1 %	3.1 %		0.6 %	6.2 %	2.1 %	1.6 %	-2.3 %	-7.4 %	-2.5 %	8.3 %	1.7 %	1992-Q1	10	-8.6 %
	1997-Q3	22	38.8 %	36.8 %		7.4 %	17.0 %	5.7 %	5.3 %	-4.2 %	-3.6 %	-1.2 %	3.0 %	0.6 %	2001-Q1	14	-5.5 %

	2007-Q2	25	89.9 %	77.9 %		15.6 %	32.2 %	10.7 %	10.7 %	-7.6 %	-12.2 %	-4.1 %	-13.4 %	-2.7 %	2011-Q2	16	-15.4 %
Norway															1976-Q1	24	-20.0 %
	1982-Q2	25	56.8 %	31.7 %		6.3 %	26.7 %	8.9 %	12.4 %	-6.3 %	-6.1 %	-2.0 %	33.5 %	6.7 %	1985-Q1	11	-6.5 %
	1987-Q1	8	44.0 %	37.8 %		7.6 %	39.8 %	13.3 %	25.0 %	-2.3 %	-28.6 %	-9.5 %	-41.2 %	-8.2 %	1993-Q1	24	-45.5 %
	2007-Q2	57	205.1 %	42.6 %		8.5 %	35.0 %	11.7 %	14.1 %	-2.3 %	-0.5 %	-0.2 %	11.7 %	2.3 %	2008-Q4	6	-13.7 %
South Africa	1973-Q4	15	13.1 %	13.1 %	*	3.5 %	8.8 %	2.9 %	7.5 %	-8.9 %	-17.3 %	-5.8 %	-27.1 %	-5.4 %	1978-Q4	20	-27.1 %
	1984-Q1	21	55.1 %	54.9 %		11.0 %	25.5 %	8.5 %	9.2 %	-18.1 %	-44.1 %	-14.7 %	-42.8 %	-8.6 %	1987-Q1	12	-44.1 %
	1990-Q2	13	3.9 %	-24.4 %		-4.9 %	3.5 %	1.2 %	0.4 %	-2.0 %	-15.5 %	-5.2 %	-15.3 %	-3.1 %	1997-Q1	27	-21.2 %
	2007-Q3	42	211.0 %	120.0 %		24.0 %	43.6 %	14.5 %	8.6 %	-7.0 %	-12.9 %	-4.3 %	-17.6 %	-3.5 %	2012-Q2	19	-19.1 %
Spain	1974-Q2	17	30.1 %	30.1 %	*	7.1 %	27.9 %	9.3 %	24.8 %	-9.3 %	0.4 %	0.1 %	0.9 %	0.2 %	1976-Q1	7	-13.2 %
	1978-Q2	9	29.7 %	40.6 %		8.1 %	24.1 %	8.0 %	12.2 %	-10.4 %	-25.9 %	-8.6 %	-30.8 %	-6.2 %	1982-Q4	18	-36.7 %
	1991-Q4	36	142.3 %	102.4 %		20.5 %	34.2 %	11.4 %	10.9 %	-12.5 %	-18.7 %	-6.2 %	-21.0 %	-4.2 %	1997-Q1	21	-21.2 %
	2007-Q2	41	138.8 %	69.2 %		13.8 %	30.1 %	10.0 %	9.0 %	-4.5 %	-14.1 %	-4.7 %	-36.0 %	-7.2 %	2014-Q1	27	-45.5 %
Sweden	1979-Q3	38	27.4 %	30.2 %		6.0 %	10.9 %	3.6 %	4.0 %	-11.1 %	-28.2 %	-9.4 %	-36.7 %	-7.3 %	1985-Q4	25	-39.8 %
	1990-Q1	17	46.6 %	42.5 %		8.5 %	35.9 %	12.0 %	8.8 %	-1.6 %	-28.4 %	-9.5 %	-30.0 %	-6.0 %	1995-Q4	23	-31.9 %
Switzerland	1973-Q1	12	27.7 %	27.7 %	*	9.2 %	27.7 %	9.2 %	17.7 %	-10.6 %	-27.8 %	-9.3 %	-26.6 %	-5.3 %	1976-Q3	14	-28.4 %
	1989-Q4	53	72.1 %	38.1 %		7.6 %	28.7 %	9.6 %	4.6 %	-8.0 %	-21.6 %	-7.2 %	-27.6 %	-5.5 %	2000-Q1	41	-38.6 %
UK	1973-Q3	14	67.4 %	67.4 %	*	19.3 %	66.2 %	22.1 %	23.5 %	-11.2 %	-28.9 %	-9.6 %	-29.3 %	-5.9 %	1977-Q3	16	-35.6 %
	1980-Q1	10	32.6 %	0.8 %		0.2 %	26.2 %	8.7 %	10.4 %	-6.2 %	-12.2 %	-4.1 %	-5.0 %	-1.0 %	1982-Q1	8	-16.5 %
	1989-Q3	30	103.6 %	77.8 %		15.6 %	58.1 %	19.4 %	10.6 %	-9.4 %	-24.7 %	-8.2 %	-26.6 %	-5.3 %	1995-Q4	25	-29.3 %
	2007-Q3	47	175.3 %	45.0 %		9.0 %	15.5 %	5.2 %	8.8 %	-7.0 %	-11.2 %	-3.7 %	-17.0 %	-3.4 %	2013-Q1	22	-18.9 %
USA	1974-Q1	16	14.3 %	14.3 %	*	3.6 %	13.3 %	4.4 %	1.5 %	-3.8 %	1.4 %	0.5 %	21.2 %	4.2 %	1976-Q2	9	-7.0 %
	1979-Q3	13	33.5 %	25.5 %		5.1 %	28.9 %	9.6 %	5.9 %	-3.0 %	-9.9 %	-3.3 %	-8.5 %	-1.7 %	1982-Q4	13	-11.2 %
	1989-Q2	26	28.8 %	25.3 %		5.1 %	18.0 %	6.0 %	4.3 %	-1.9 %	-10.9 %	-3.6 %	-12.7 %	-2.5 %	1996-Q3	29	-13.7 %
	2006-Q1	38	92.9 %	54.1 %		10.8 %	35.4 %	11.8 %	7.8 %	-4.3 %	-33.0 %	-11.0 %	-37.1 %	-7.4 %	2011-Q4	23	-39.6 %

Appendix Table IV. Nominal prices for the peaks and troughs in the short dataset

Note: This table shows the changes in nominal prices around all the identified peaks and troughs in the short dataset. The short dataset consists of quarterly nominal prices for 20 OECD countries from 1970–2015.The turning points are identified using an algorithm described in section 4. Duration is the number of quarters since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration. Quarters below peak shows the number of quarters before nominal prices rise to the last peak again.

*Shows the aggregated price change from the start of the period to the peak.

¤Shows the aggregated price change from the peak to the end of the period.

				Price change prior to peak					Price change after peak							
	Peaks	Dur.	Agg. Price change	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year	1 year	Agg. 3 year	An. 3Y average	Agg. 5 year	An. 5Y average	Troughs	Dur.	Agg. Price change
Australia	1974-Q2	17	89.6 %	89.6 % *	21.1 %	67.1 %	22.4 %	27.3 %	10.1 %	34.1 %	11.4 %	59.6 %	11.9 %	1978-Q4	18	42.5 %
	1981-Q2	10	46.7 %	68.8 %	13.8 %	49.0 %	16.3 %	17.2 %	4.8 %	19.6 %	6.5 %	43.9 %	8.8 %	1983-Q3	9	8.2 %
	1985-Q1	6	20.9 %	61.1 %	12.2 %	28.7 %	9.6 %	11.9 %	7.1 %	23.2 %	7.7 %	74.2 %	14.8 %	1987-Q2	9	10.7 %
	1989-Q2	8	56.1 %	88.9 %	17.8 %	57.0 %	19.0 %	33.1 %	1.7 %	5.2 %	1.7 %	11.7 %	2.3 %	1991-Q1	7	1.3 %
	1994-Q3	14	11.9 %	13.4 %	2.7 %	7.3 %	2.4 %	4.8 %	0.0 %	5.6 %	1.9 %	21.5 %	4.3 %	1996-Q1	6	-0.4 %
	2003-Q4	31	118.9 %	90.4 %	18.1 %	63.1 %	21.0 %	18.9 %	0.3 %	11.5 %	3.8 %	21.2 %	4.2 %	2005-Q3	7	0.7 %
	2010-Q2	19	44.7 %	44.5 %	8.9 %	24.0 %	8.0 %	15.6 %	-2.2 %	1.3 %	0.4 %	22.5 %	4.5 %	2011-Q4	6	-4.7 %
Belgium														1971-Q4	7	-2.1 %
	1979-Q3	31	184.6 %	92.7 %	18.5 %	41.1 %	13.7 %	8.1 %	-1.0 %	-7.8 %	-2.6 %	-8.3 %	-1.7 %	1985-Q2	23	-10.1 %
	2007-Q4	90	345.0 %	53.6 %	10.7 %	30.9 %	10.3 %	6.8 %	3.3 %	7.1 %	2.4 %	12.0 %	2.4 %	2009-Q2	6	1.0 %
	2011-Q3	9	9.9 %	19.4 %	3.9 %	6.8 %	2.3 %	4.3 %	1.8 %	2.2 %	0.7 %	4.7 % ¤	1.1 %			
Canada	1976-Q4	27	129.6 %	107.4 %	21.5 %	46.9 %	15.6 %	9.6 %	3.8 %	22.2 %	7.4 %	55.4 %	11.1 %	1978-Q3	7	6.3 %
	1981-Q1	10	39.5 %	55.8 %	11.2 %	43.4 %	14.5 %	19.6 %	0.5 %	2.0 %	0.7 %	18.1 %	3.6 %	1984-Q3	14	0.7 %
	1989-Q1	18	102.9 %	100.3 %	20.1 %	73.0 %	24.3 %	22.7 %	-2.9 %	-3.2 %	-1.1 %	4.2 %	0.8 %	1991-Q3	10	-5.9 %
	1994-Q1	10	10.8 %	4.2 %	0.8 %	8.3 %	2.8 %	3.5 %	-3.9 %	-4.1 %	-1.4 %	-3.7 %	-0.7 %	1998-Q3	18	-5.5 %
Denmark	1973-Q4	15	60.3 %	60.3 % *	16.1 %	60.3 %	20.1 %	15.8 %	4.8 %	34.5 %	11.5 %	74.5 %	14.9 %	1977-Q1	13	35.1 %
	1979-Q2	9	38.4 %	93.5 %	18.7 %	47.7 %	15.9 %	10.9 %	-3.5 %	-7.9 %	-2.6 %	26.7 %	5.3 %	1982-Q4	14	-7.9 %
	1986-Q2	14	83.7 %	80.5 %	16.1 %	50.3 %	16.8 %	16.4 %	-7.9 %	-6.7 %	-2.2 %	-13.5 %	-2.7 %	1993-Q2	28	-19.3 %
	2006-Q3	53	269.2 %	79.5 %	15.9 %	67.5 %	22.5 %	23.5 %	0.9 %	-16.0 %	-5.3 %	-15.9 %	-3.2 %	2012-Q4	25	-17.8 %
Finland														1971-Q4	7	9.6 %
	1974-Q2	10	63.3 %	79.0 % *	18.6 %	70.9 %	23.6 %	23.3 %	3.1 %	14.8 %	4.9 %	21.6 %	4.3 %	1979-Q3	21	23.9 %

	1984-Q1	18	107.6 %	114.2 %		22.8 %	65.0 %	21.7 %	15.9 %	6.1 %	16.0 %	5.3 %	102.0 %	20.4 %	1985-Q3	6	5.3 %
	1989-Q2	15	95.5 %	105.0 %		21.0 %	89.0 %	29.7 %	31.4 %	-5.3 %	-31.1 %	-10.4 %	-34.9 %	-7.0 %	1995-Q4	26	-39.1 %
	2007-Q2	46	133.9 %	37.0 %		7.4 %	19.7 %	6.6 %	6.0 %	2.7 %	8.0 %	2.7 %	14.8 %	3.0 %	2009-Q1	7	-3.9 %
	2011-Q2	9	17.1 %	19.3 %		3.9 %	9.6 %	3.2 %	4.2 %	1.9 %	3.0 %	1.0 %	2.6 %	¤ 0.6 %			
France	1980-Q3	42	254.0 %	104.8 %		21.0 %	52.7 %	17.6 %	21.1 %	9.3 %	21.1 %	7.0 %	29.4 %	5.9 %	1986-Q1	22	29.0 %
	1991-Q3	22	60.1 %	52.5 %		10.5 %	27.1 %	9.0 %	4.7 %	-3.5 %	-4.5 %	-1.5 %	-4.4 %	-0.9 %	1997-Q1	22	-8.8 %
	2007-Q4	43	158.6 %	74.1 %		14.8 %	33.2 %	11.1 %	5.5 %	-3.5 %	-0.1 %	0.0 %	1.5 %	0.3 %	2009-Q2	6	-8.5 %
	2011-Q3	9	14.2 %	11.3 %		2.3 %	4.7 %	1.6 %	5.9 %	-1.5 %	-4.7 %	-1.6 %	-6.5 %	¤ -1.5 %			
Germany	1974-Q2	17	42.7 %	42.7 %	*	10.0 %	23.3 %	7.8 %	7.5 %	1.2 %	7.8 %	2.6 %	27.8 %	5.6 %	1976-Q3	9	3.1 %
	1981-Q2	19	42.5 %	43.4 %		8.7 %	28.7 %	9.6 %	7.3 %	1.2 %	-1.2 %	-0.4 %	-1.1 %	-0.2 %	1998-Q4	70	12.6 %
	2000-Q3	7	2.0 %	-1.3 %		-0.3 %	1.4 %	0.5 %	1.6 %	1.2 %	0.9 %	0.3 %	6.1 %	1.2 %	2010-Q1	38	7.4 %
Ireland	1980-Q4	43	155.5 %	170.9 %		34.2 %	87.8 %	29.3 %	25.1 %	12.3 %	16.3 %	5.4 %	26.7 %	5.3 %	1987-Q2	26	21.9 %
	1990-Q3	13	45.6 %	43.2 %		8.6 %	36.4 %	12.1 %	14.0 %	-0.1 %	6.3 %	2.1 %	15.6 %	3.1 %	1993-Q1	10	0.7 %
	2007-Q1	56	402.4 %	79.8 %		16.0 %	43.4 %	14.5 %	14.9 %	-2.5 %	-30.9 %	-10.3 %	-49.1 %	-9.8 %	2013-Q1	24	-50.7 %
Italy	1974-Q3	18	117.7 %	117.7 %	*	26.2 %	105.0 %	35.0 %	54.2 %	13.9 %	46.7 %	15.6 %	102.3 %	20.5 %	1978-Q1	14	53.2 %
	1981-Q2	13	129.6 %	175.2 %		35.0 %	117.3 %	39.1 %	40.1 %	11.6 %	25.0 %	8.3 %	30.8 %	6.2 %	1986-Q4	22	32.6 %
	1992-Q4	24	123.5 %	107.0 %		21.4 %	50.6 %	16.9 %	14.2 %	1.8 %	3.1 %	1.0 %	9.4 %	1.9 %	1999-Q1	25	9.1 %
	2007-Q3	34	68.5 %	34.6 %		6.9 %	18.9 %	6.3 %	4.6 %	2.6 %	0.1 %	0.0 %	-2.8 %	-0.6 %			
Japan	1973-Q4	15	110.7 %	110.7 %	*	29.5 %	85.7 %	28.6 %	31.3 %	2.9 %	4.2 %	1.4 %	16.2 %	3.2 %	1977-Q3	15	7.7 %
	1990-Q4	53	155.2 %	46.8 %		9.4 %	30.2 %	10.1 %	12.4 %	-0.2 %	-8.3 %	-2.8 %	-11.5 %	-2.3 %	2009-Q2	74	-46.0 %
	2013-Q3	17	4.0 %	-0.6 %		-0.1 %	1.2 %	0.4 %	2.5 %	1.1 %	2.6 %	¤ 1.1 %	2.6 %	¤ 1.1 %			
Korea	1979-Q2	37	249.8 %	249.8 %		50.0 %	145.5 %	48.5 %	21.4 %	9.5 %	20.9 %	7.0 %	65.4 %	13.1 %	1982-Q2	12	20.9 %
	1986-Q1	15	60.1 %	69.2 %		13.8 %	39.2 %	13.1 %	11.6 %	-3.0 %	23.0 %	7.7 %	66.8 %	13.4 %	1987-Q3	6	-1.3 %
	1991-Q1	14	68.9 %	66.8 %		13.4 %	54.3 %	18.1 %	17.5 %	-3.1 %	-9.9 %	-3.3 %	-9.9 %	-2.0 %	2001-Q1	40	-15.1 %
	2008-Q2	29	62.5 %	23.2 %		4.6 %	21.2 %	7.1 %	4.4 %	-0.6 %	7.5 %	2.5 %	10.5 %	2.1 %	2013-Q2	20	10.5 %
Netherlands	1978-Q2	33	333.4 %	183.9 %		36.8 %	105.7 %	35.2 %	11.4 %	-8.0 %	-23.6 %	-7.9 %	-31.6 %	-6.3 %	1985-Q3	29	-33.2 %
	2007-Q4	89	387.8 %	23.6 %		4.7 %	14.3 %	4.8 %	5.3 %	-0.6 %	-6.2 %	-2.1 %	-15.7 %	-3.1 %	2013-Q4	24	-19.4 %
New Zealand	1974-Q3	18	140.7 %	140.7 %	*	31.3 %	106.8 %	35.6 %	42.0 %	4.7 %	20.4 %	6.8 %	29.1 %	5.8 %	1980-Q4	25	46.9 %
	1985-Q1	17	106.9 %	127.5 %		25.5 %	44.9 %	15.0 %	13.0 %	13.5 %	50.4 %	16.8 %	71.7 %	14.3 %	1987-Q1	8	26.9 %
	1989-Q3	10	30.1 %	75.8 %		15.2 %	40.4 %	13.5 %	6.1 %	5.2 %	3.7 %	1.2 %	24.1 %	4.8 %	1992-Q1	10	1.5 %
	1997-Q3	22	54.2 %	51.0 %		10.2 %	26.1 %	8.7 %	6.5 %	-2.6 %	-0.3 %	-0.1 %	12.9 %	2.6 %	2001-Q1	14	0.2 %

	2007-Q2	25	119.7 %	101.1 %		20.2 %	43.7 %	14.6 %	13.4 %	-4.5 %	-4.5 %	-1.5 %	0.1 %	0.0 %	2011-Q2	16	-3.8 %
Norway															1976-Q1	24	36.0 %
	1982-Q2	25	174.9 %	107.6 %		21.5 %	73.9 %	24.6 %	25.2 %	3.0 %	16.1 %	5.4 %	91.0 %	18.2 %	1985-Q1	11	13.7 %
	1987-Q1	8	64.7 %	99.9 %		20.0 %	69.6 %	23.2 %	35.5 %	5.0 %	-14.9 %	-5.0 %	-24.6 %	-4.9 %	1993-Q1	24	-28.5 %
	2007-Q2	57	300.0 %	53.3 %		10.7 %	40.7 %	13.6 %	15.3 %	1.2 %	8.7 %	2.9 %	24.7 %	4.9 %	2008-Q4	6	-9.2 %
South Africa	1973-Q4	15	46.3 %	46.3 %	*	12.4 %	34.2 %	11.4 %	17.7 %	2.5 %	17.7 %	5.9 %	29.2 %	5.8 %	1978-Q4	20	29.2 %
	1984-Q1	21	196.5 %	189.3 %		37.9 %	80.0 %	26.7 %	20.5 %	-7.0 %	-9.9 %	-3.3 %	19.3 %	3.9 %	1987-Q1	12	-9.9 %
	1990-Q2	13	60.0 %	58.0 %		11.6 %	53.5 %	17.8 %	15.5 %	12.2 %	23.3 %	7.8 %	49.0 %	9.8 %	1997-Q1	27	58.0 %
	2007-Q3	42	417.3 %	158.6 %		31.7 %	58.7 %	19.6 %	15.0 %	2.4 %	8.2 %	2.7 %	13.6 %	2.7 %	2012-Q2	19	9.8 %
Spain	1974-Q2	17	76.9 %	76.9 %	*	18.1 %	71.1 %	23.7 %	42.2 %	8.2 %	67.4 %	22.5 %	141.7 %	28.3 %	1976-Q1	7	14.2 %
	1978-Q2	9	102.0 %	228.0 %		45.6 %	113.2 %	37.7 %	37.8 %	4.8 %	16.8 %	5.6 %	41.6 %	8.3 %	1982-Q4	18	22.1 %
	1991-Q4	36	367.5 %	166.6 %		33.3 %	61.0 %	20.3 %	17.3 %	-7.4 %	-5.7 %	-1.9 %	-0.7 %	-0.1 %	1997-Q1	21	-0.5 %
	2007-Q2	41	216.9 %	97.1 %		19.4 %	43.0 %	14.3 %	11.6 %	-0.3 %	-8.7 %	-2.9 %	-28.1 %	-5.6 %	2014-Q1	27	-36.2 %
Sweden	1979-Q3	38	180.6 %	106.8 %		21.4 %	44.3 %	14.8 %	10.3 %	1.2 %	0.9 %	0.3 %	5.4 %	1.1 %	1985-Q4	25	8.5 %
	1990-Q1	17	82.1 %	85.6 %		17.1 %	60.5 %	20.2 %	15.7 %	9.5 %	-12.1 %	-4.0 %	-8.0 %	-1.6 %	1995-Q4	23	-9.0 %
Switzerland	1973-Q1	12	52.6 %	52.6 %	*	17.5 %	52.6 %	17.5 %	25.5 %	-0.6 %	-8.8 %	-2.9 %	-5.0 %	-1.0 %	1976-Q3	14	-9.3 %
	1989-Q4	53	151.8 %	53.2 %		10.6 %	37.4 %	12.5 %	7.9 %	-2.5 %	-8.5 %	-2.8 %	-12.0 %	-2.4 %	2000-Q1	41	-21.9 %
UK	1973-Q3	14	120.6 %	120.6 %	*	34.4 %	109.9 %	36.6 %	34.4 %	3.5 %	21.0 %	7.0 %	52.3 %	10.5 %	1977-Q3	16	29.1 %
	1980-Q1	10	72.1 %	109.8 %		22.0 %	80.2 %	26.7 %	29.1 %	8.4 %	20.9 %	7.0 %	44.0 %	8.8 %	1982-Q1	8	8.4 %
	1989-Q3	30	189.9 %	121.4 %		24.3 %	79.1 %	26.4 %	16.3 %	-3.2 %	-8.8 %	-2.9 %	-7.2 %	-1.4 %	1995-Q4	25	-8.2 %
	2007-Q3	47	233.2 %	59.0 %		11.8 %	23.4 %	7.8 %	11.5 %	-3.7 %	-2.8 %	-0.9 %	-2.6 %	-0.5 %	2013-Q1	22	-3.3 %
USA	1974-Q1	16	39.7 %	39.7 %	*	9.9 %	31.1 %	10.4 %	9.9 %	8.1 %	28.3 %	9.4 %	77.6 %	15.5 %	1976-Q2	9	13.2 %
	1979-Q3	13	70.2 %	84.1 %		16.8 %	62.5 %	20.8 %	17.1 %	11.2 %	21.2 %	7.1 %	32.8 %	6.6 %	1982-Q4	13	21.7 %
	1989-Q2	26	60.2 %	48.7 %		9.7 %	31.3 %	10.4 %	9.3 %	3.2 %	1.7 %	0.6 %	5.4 %	1.1 %	1996-Q3	29	11.2 %
	2006-Q1	38	143.0 %	74.8 %		15.0 %	47.6 %	15.9 %	11.8 %	-2.4 %	-27.5 %	-9.2 %	-30.0 %	-6.0 %	2011-Q4	23	-30.5 %

Appendix Table V. Real prices for the peaks and troughs in the long dataset

Note: This table shows the changes in real prices around all the identified peaks and troughs in the long dataset. The long dataset consists of annual real prices for 6 countries and 2 cities, dating back to the 1800s.The turning points are identified using an algorithm described in section 4. Duration is the number of years since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration. Years below peak shows the number of years before real prices rise to the last peak again.

*Shows the aggregated price change from the start of the period to the peak.

¤Shows the aggregated price change from the peak to the end of the period.

				Price change prior to peak					Price change after peak							
	Peaks	**Dur.**	**Agg. Price change**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year	1 year	Agg. 3 year	An. 3Y average	Agg. 5 year	An. 5Y average	**Troughs**	**Dur.**	**Agg. Price change**
Amsterdam	1852	2	8.1 %	8.1 % *	4.1 %	8.1 % *	4.1 %	6.2 %	-16.6 %	-14.0 %	-4.7 %	-16.0 %	-3.2 %	1857	5	-16.0 %
	1868	11	59.1 %	16.5 %	3.3 %	5.5 %	1.8 %	14.5 %	-18.1 %	-21.8 %	-7.3 %	-0.1 %	0.0 %	1871	3	-21.8 %
	1882	11	89.1 %	24.5 %	4.9 %	10.2 %	3.4 %	1.2 %	-7.5 %	-9.6 %	-3.2 %	10.1 %	2.0 %	1884	2	-11.7 %
	1887	3	24.7 %	10.1 %	2.0 %	24.7 %	8.2 %	23.7 %	-18.5 %	-29.7 %	-9.9 %	-6.0 %	-1.2 %	1891	4	-33.4 %
	1895	4	12.2 %	6.1 %	1.2 %	-20.6 %	-6.9 %	5.0 %	-2.2 %	0.5 %	0.2 %	-1.2 %	-0.2 %	1897	2	-5.3 %
	1902	5	29.7 %	29.7 %	5.9 %	14.4 %	4.8 %	12.7 %	-7.1 %	-16.6 %	-5.5 %	-13.6 %	-2.7 %	1909	7	-34.3 %
	1913	4	17.6 %	-10.3 %	-2.1 %	2.9 %	1.0 %	12.4 %	-13.4 %	-64.5 %	-21.5 %	-67.6 %	-13.5 %	1918	5	-67.6 %
	1928	10	140.6 %	15.8 %	3.2 %	27.9 %	9.3 %	20.4 %	-3.1 %	-3.9 %	-1.3 %	11.6 %	2.3 %	1932	4	-28.5 %
	1934	2	243.4 %	153.6 %	30.7 %	155.5 %	51.8 %	120.1 %	-63.9 %	-74.7 %	-24.9 %	-59.6 %	-11.9 %	1937	3	-74.7 %
	1939	2	59.9 %	-59.6 %	-11.9 %	53.0 %	17.7 %	12.6 %	-41.6 %	-41.8 %	-13.9 %	-40.4 %	-8.1 %	1943	4	-54.8 %
	1949	6	9.5 %	-17.0 %	-3.4 %	23.2 %	7.7 %	81.2 %	-48.0 %	-48.4 %	-16.1 %	-62.4 %	-12.5 %	1954	5	-62.4 %
	1964	10	302.6 %	122.6 %	24.5 %	48.5 %	16.2 %	27.8 %	-6.8 %	-9.8 %	-3.3 %	-9.9 %	-2.0 %	1966	2	-11.6 %
	1968	2	5.3 %	19.0 %	3.8 %	-0.1 %	0.0 %	3.2 %	-3.2 %	-7.6 %	-2.5 %	-3.6 %	-0.7 %	1972	4	-10.1 %
	1978	6	98.2 %	84.8 %	17.0 %	68.4 %	22.8 %	5.0 %	-10.1 %	-37.7 %	-12.6 %	-47.2 %	-9.4 %	1985	7	-50.7 %
	2007	22	156.0 %	11.2 %	2.2 %	8.8 %	2.9 %	1.2 %	-7.3 %	-10.8 %	-3.6 %	-10.8 % ¤	-3.6 %			
Australia														1883	3	-0.3 %
	1889	6	42.5 %	23.3 %	4.7 %	21.3 %	7.1 %	14.3 %	-7.0 %	-10.2 %	-3.4 %	-38.6 %	-7.7 %	1894	5	-38.6 %
	1902	8	29.9 %	10.8 %	2.2 %	22.0 %	7.3 %	2.5 %	-9.7 %	-16.1 %	-5.4 %	-7.9 %	-1.6 %	1905	3	-16.1 %
	1908	3	10.9 %	3.1 %	0.6 %	10.9 %	3.6 %	1.0 %	-0.3 %	-4.3 %	-1.4 %	5.0 %	1.0 %	1911	3	-4.3 %
	1913	2	9.7 %	5.0 %	1.0 %	8.5 %	2.8 %	2.1 %	-1.8 %	-13.8 %	-4.6 %	-9.8 %	-2.0 %	1917	4	-14.2 %
	1924	7	37.5 %	36.8 %	7.4 %	15.8 %	5.3 %	3.6 %	-4.3 %	-5.9 %	-2.0 %	-4.6 %	-0.9 %	1930	6	-16.4 %

	1937	7	12.3 %	9.3 %	1.9 %	3.3 %	1.1 %	1.0 %	-1.7 %	0.0 %	0.0 %	4.8 %	1.0 %	1939	2	-2.3 %
	1942	3	7.3 %	4.8 %	1.0 %	7.3 %	2.4 %	2.0 %	-4.8 %	-5.5 %	-1.8 %	-9.5 %	-1.9 %	1949	7	-26.9 %
	1951	2	113.6 %	68.2 %	13.6 %	104.6 %	34.9 %	0.5 %	-17.9 %	-23.4 %	-7.8 %	-12.1 %	-2.4 %	1953	2	-27.3 %
	1974	21	156.2 %	43.2 %	8.6 %	26.7 %	8.9 %	5.9 %	-6.4 %	-11.1 %	-3.7 %	-13.6 %	-2.7 %	1979	5	-13.6 %
	1981	2	16.0 %	11.1 %	2.2 %	14.9 %	5.0 %	4.9 %	-6.4 %	-3.2 %	-1.1 %	0.1 %	0.0 %	1983	2	-9.9 %
	1989	6	56.9 %	45.9 %	9.2 %	41.1 %	13.7 %	28.9 %	-6.7 %	-12.3 %	-4.1 %	-10.9 %	-2.2 %	1993	4	-13.0 %
	2004	11	93.6 %	57.3 %	11.5 %	37.3 %	12.4 %	3.3 %	-2.2 %	1.3 %	0.4 %	3.6 %	0.7 %	2006	2	-3.4 %
France														1941	15	-45.5 %
	1943	2	42.4 %	-1.1 %	-0.2 %	28.1 %	9.4 %	25.1 %	-4.1 %	-58.4 %	-19.5 %	-79.9 %	-16.0 %	1948	5	-79.9 %
	1980	32	1238.2 %	25.5 %	5.1 %	11.6 %	3.9 %	6.3 %	-2.4 %	-12.6 %	-4.2 %	-17.8 %	-3.6 %	1985	5	-17.8 %
	1991	6	33.7 %	31.1 %	6.2 %	16.6 %	5.5 %	2.0 %	-4.8 %	-9.8 %	-3.3 %	-13.2 %	-2.6 %	1996	5	-13.2 %
	2007	11	112.6 %	63.3 %	12.7 %	31.7 %	10.6 %	5.1 %	-1.6 %	-4.3 %	-1.4 %	-4.3 %	¤ -1.4 %			
Norway	1859	9	70.5 %	60.9 %	12.2 %	53.1 %	17.7 %	18.7 %	-25.1 %	-29.9 %	-10.0 %	-32.2 %	-6.4 %	1868	9	-35.3 %
	1878	10	127.9 %	61.8 %	12.4 %	32.3 %	10.8 %	20.9 %	-5.6 %	-18.7 %	-6.2 %	-9.7 %	-1.9 %	1880	2	-19.9 %
	1887	7	33.5 %	20.8 %	4.2 %	25.4 %	8.5 %	8.5 %	-5.8 %	-9.9 %	-3.3 %	-4.6 %	-0.9 %	1889	2	-13.2 %
	1898	9	56.7 %	18.9 %	3.8 %	9.2 %	3.1 %	2.5 %	-0.1 %	-17.9 %	-6.0 %	-15.7 %	-3.1 %	1900	2	-19.0 %
	1902	2	4.8 %	-13.1 %	-2.6 %	-15.1 %	-5.0 %	3.3 %	-0.6 %	-18.1 %	-6.0 %	-21.7 %	-4.3 %	1907	5	-21.7 %
	1910	3	13.9 %	8.8 %	1.8 %	13.9 %	4.6 %	7.9 %	-2.6 %	1.7 %	0.6 %	-38.9 %	-7.8 %	1912	2	-4.9 %
	1914	2	7.6 %	10.4 %	2.1 %	5.0 %	1.7 %	0.6 %	-40.3 %	-66.2 %	-22.1 %	-67.3 %	-13.5 %	1921	7	-70.9 %
	1933	12	73.6 %	16.8 %	3.4 %	12.2 %	4.1 %	2.5 %	-5.8 %	-1.7 %	-0.6 %	-10.7 %	-2.1 %	1935	2	-7.8 %
	1939	4	4.0 %	1.9 %	0.4 %	-2.4 %	-0.8 %	7.4 %	-16.6 %	-34.6 %	-11.5 %	-37.4 %	-7.5 %	1944	5	-37.4 %
	1949	5	11.5 %	11.5 %	2.3 %	8.7 %	2.9 %	5.9 %	-2.9 %	-25.7 %	-8.6 %	-32.8 %	-6.6 %	1954	5	-32.8 %
	1972	18	64.4 %	13.6 %	2.7 %	7.0 %	2.3 %	5.9 %	-2.9 %	-8.2 %	-2.7 %	-4.5 %	-0.9 %	1976	4	-13.7 %
	1987	11	110.3 %	41.1 %	8.2 %	42.6 %	14.2 %	14.3 %	-7.0 %	-30.1 %	-10.0 %	-44.5 %	-8.9 %	1992	5	-44.5 %
Paris														1855	5	-10.2 %
	1859	4	67.3 %	60.3 %	12.1 %	55.5 %	18.5 %	14.4 %	-12.1 %	-15.1 %	-5.0 %	-9.8 %	-2.0 %	1861	2	-18.3 %
	1869	8	38.1 %	25.0 %	5.0 %	13.1 %	4.4 %	10.8 %	-8.6 %	-27.8 %	-9.3 %	-41.3 %	-8.3 %	1874	5	-41.3 %
	1889	15	71.9 %	11.5 %	2.3 %	8.8 %	2.9 %	3.1 %	-0.6 %	1.7 %	0.6 %	1.1 %	0.2 %	1891	2	-2.5 %
	1893	2	9.7 %	10.4 %	2.1 %	7.7 %	2.6 %	5.2 %	-5.6 %	-5.9 %	-2.0 %	-3.8 %	-0.8 %	1895	2	-7.7 %
	1906	11	22.0 %	2.6 %	0.5 %	5.0 %	1.7 %	2.0 %	-4.2 %	-1.6 %	-0.5 %	-6.4 %	-1.3 %	1908	2	-4.4 %
	1910	2	5.2 %	2.6 %	0.5 %	5.0 %	1.7 %	2.2 %	-6.9 %	-5.8 %	-1.9 %	-16.1 %	-3.2 %	1912	2	-8.0 %

	1914	2	5.5 %	-0.8 %		-0.2 %	4.2 %	1.4 %	3.0 %	-13.5 %	-35.5 %	-11.8 %	-66.7 %	-13.3 %	1920	6	-79.6 %
	1935	15	82.8 %	35.0 %		7.0 %	8.3 %	2.8 %	3.2 %	-11.7 %	-45.4 %	-15.1 %	-50.4 %	-10.1 %	1940	5	-50.4 %
	1942	2	3.4 %	-19.1 %		-3.8 %	-2.9 %	-1.0 %	1.8 %	-16.2 %	-59.7 %	-19.9 %	-86.2 %	-17.2 %	1950	8	-93.3 %
	1969	19	2034.7 %	37.8 %		7.6 %	12.7 %	4.2 %	8.0 %	-1.5 %	1.7 %	0.6 %	9.1 %	1.8 %	1975	6	4.5 %
	1981	6	11.6 %	5.5 %		1.1 %	8.2 %	2.7 %	0.4 %	-9.6 %	-15.2 %	-5.1 %	-3.0 %	-0.6 %	1984	3	-15.2 %
	1990	6	114.4 %	104.5 %		20.9 %	64.6 %	21.5 %	14.2 %	-1.6 %	-21.5 %	-7.2 %	-29.9 %	-6.0 %	1997	7	-40.1 %
Sweden	1887	12	68.9 %	28.5 %		5.7 %	13.0 %	4.3 %	4.3 %	-4.1 %	-9.5 %	-3.2 %	-10.9 %	-2.2 %	1891	4	-11.5 %
	1896	5	13.0 %	13.0 %		2.6 %	5.4 %	1.8 %	2.0 %	-0.8 %	-2.6 %	-0.9 %	2.6 %	0.5 %	1899	3	-2.6 %
	1906	7	16.1 %	10.2 %		2.0 %	8.3 %	2.8 %	4.1 %	-3.0 %	-3.5 %	-1.2 %	-4.9 %	-1.0 %	1919	13	-66.7 %
	1931	12	99.2 %	13.7 %		2.7 %	12.2 %	4.1 %	4.5 %	-2.4 %	-6.1 %	-2.0 %	-5.1 %	-1.0 %	1937	6	-13.0 %
	1939	2	5.3 %	-2.4 %		-0.5 %	-3.4 %	-1.1 %	2.8 %	-17.3 %	-34.3 %	-11.4 %	-27.9 %	-5.6 %	1942	3	-34.3 %
	1947	5	32.7 %	32.7 %		6.5 %	21.0 %	7.0 %	8.6 %	-10.5 %	-13.2 %	-4.4 %	-29.2 %	-5.8 %	1958	11	-32.5 %
	1965	7	22.9 %	20.1 %		4.0 %	13.5 %	4.5 %	6.3 %	-0.5 %	-3.4 %	-1.1 %	-5.9 %	-1.2 %	1974	9	-20.0 %
	1979	5	19.5 %	19.5 %		3.9 %	7.6 %	2.5 %	3.7 %	-8.1 %	-18.5 %	-6.2 %	-24.1 %	-4.8 %	1984	5	-24.1 %
	1990	6	74.0 %	70.3 %		14.1 %	40.1 %	13.4 %	8.7 %	-9.2 %	-37.6 %	-12.5 %	-35.5 %	-7.1 %	1993	3	-37.6 %
UK															1934	4	-4.5 %
	1936	2	5.5 %	-4.7 %		-0.9 %	2.5 %	0.8 %	3.1 %	-5.6 %	-8.6 %	-2.9 %	-32.2 %	-6.4 %	1945	9	-42.5 %
	1947	2	212.2 %	185.2 %		37.0 %	203.6 %	67.9 %	18.0 %	-11.6 %	-7.6 %	-2.5 %	-19.9 %	-4.0 %	1954	7	-26.1 %
	1956	2	5.8 %	-15.4 %		-3.1 %	1.8 %	0.6 %	5.4 %	-1.3 %	-1.5 %	-0.5 %	8.5 %	1.7 %	1958	2	-2.0 %
	1973	15	124.9 %	65.2 %		13.0 %	61.5 %	20.5 %	25.7 %	-5.5 %	-28.4 %	-9.5 %	-30.5 %	-6.1 %	1977	4	-34.4 %
	1980	3	21.7 %	1.7 %		0.3 %	21.7 %	7.2 %	0.4 %	-9.4 %	-13.2 %	-4.4 %	-8.2 %	-1.6 %	1982	2	-19.2 %
	1989	7	67.1 %	48.2 %		9.6 %	29.9 %	10.0 %	3.3 %	-0.5 %	-7.3 %	-2.4 %	-5.8 %	-1.2 %	1995	6	-7.9 %
USA	1894	4	24.0 %	24.0 %	*	6.0 %	40.9 %	13.6 %	34.3 %	-5.3 %	-14.1 %	-4.7 %	-16.2 %	-3.2 %	1896	2	-19.1 %
	1898	2	9.9 %	19.4 %		3.9 %	-6.2 %	-2.1 %	3.4 %	-5.7 %	-20.7 %	-6.9 %	-15.5 %	-3.1 %	1905	7	-20.8 %
	1907	2	25.3 %	8.8 %		1.8 %	7.3 %	2.4 %	5.6 %	-7.8 %	-14.8 %	-4.9 %	-6.4 %	-1.3 %	1910	3	-14.8 %
	1912	2	9.9 %	-6.4 %		-1.3 %	7.3 %	2.4 %	4.9 %	-6.8 %	-13.9 %	-4.6 %	-17.0 %	-3.4 %	1921	9	-35.9 %
	1925	4	19.1 %	18.3 %		3.7 %	4.5 %	1.5 %	5.2 %	-7.3 %	-6.2 %	-2.1 %	-11.1 %	-2.2 %	1932	7	-12.6 %
	1940	8	19.6 %	4.7 %		0.9 %	2.5 %	0.8 %	4.0 %	-9.7 %	-13.2 %	-4.4 %	7.4 %	1.5 %	1942	2	-16.2 %
	1947	5	59.6 %	59.6 %		11.9 %	36.1 %	12.0 %	2.7 %	-7.4 %	-3.1 %	-1.0 %	-4.9 %	-1.0 %	1949	2	-8.5 %
	1955	6	16.2 %	9.8 %		2.0 %	11.8 %	3.9 %	1.8 %	-0.7 %	-3.2 %	-1.1 %	-4.6 %	-0.9 %	1963	8	-6.4 %
	1965	2	1.3 %	-0.6 %		-0.1 %	0.3 %	0.1 %	0.9 %	-0.6 %	-4.4 %	-1.5 %	-2.8 %	-0.6 %	1968	3	-4.4 %

	1972	4	4.7 %	3.3 %	0.7 %	4.4 %	1.5 %	1.0 %	-1.2 %	-6.3 %	-2.1 %	-4.4 %	-0.9 %	1976	4	-7.5 %
	1979	3	18.0 %	15.7 %	3.1 %	18.0 %	6.0 %	6.3 %	-1.0 %	-8.2 %	-2.7 %	-10.3 %	-2.1 %	1983	4	-10.7 %
	1989	6	20.8 %	20.2 %	4.0 %	14.6 %	4.9 %	2.5 %	-1.2 %	-9.8 %	-3.3 %	-12.0 %	-2.4 %	1997	8	-13.6 %
	2006	9	73.6 %	46.2 %	9.2 %	29.8 %	9.9 %	8.6 %	-1.0 %	-22.4 %	-7.5 %	-30.8 %	-6.2 %	2012	6	-35.1 %

Appendix Table VI. Nominal prices for the peaks and troughs in the long dataset

Note: This table shows the changes in nominal prices around all the identified peaks and troughs in the long dataset. The long dataset consists of annual nominal prices for 6 countries and 2 cities, dating back to the 1800s. The turning points are identified using an algorithm described in section 4. Duration is the number of years since the last turning point (or from the start of the data series). Aggregated price change is the aggregate price change for the duration. Years below peak shows the number of years before nominal prices rise to the last peak again.

*Shows the aggregated price change from the start of the period to the peak.

¤Shows the aggregated price change from the peak to the end of the period.

				Price change					Price change after peak							
	Peaks	**Dur.**	**Agg. Price change**	Agg. 5 year	An. 5Y average	Agg. 3 year	An. 3Y average	1 year	1 year	Agg. 3 year	An. 3Y average	Agg. 5 year	An. 5Y average	**Troughs**	**Dur.**	**Agg. Price change**
Amsterdam	1852	2	11.8 %	11.8 % *	5.9 %	11.8 % *	5.9 %	9.7 %	-2.8 %	11.1 %	3.7 %	3.4 %	0.7 %	1857	5	3.4 %
	1868	11	61.5 %	20.5 %	4.1 %	9.6 %	3.2 %	13.3 %	-21.0 %	-20.9 %	-7.0 %	5.5 %	1.1 %	1871	3	-20.9 %
	1882	11	80.9 %	17.6 %	3.5 %	10.3 %	3.4 %	0.2 %	-8.7 %	-18.8 %	-6.3 %	-3.7 %	-0.7 %	1884	2	-16.9 %
	1887	3	15.9 %	-3.7 %	-0.7 %	15.9 %	5.3 %	22.9 %	-18.3 %	-27.2 %	-9.1 %	-2.7 %	-0.5 %	1891	4	-29.4 %
	1895	4	1.2 %	-2.0 %	-0.4 %	-26.6 %	-8.9 %	3.6 %	-3.4 %	1.8 %	0.6 %	8.0 %	1.6 %	1897	2	-5.5 %
	1902	5	32.0 %	32.0 %	6.4 %	12.7 %	4.2 %	12.7 %	-7.1 %	-11.8 %	-3.9 %	-6.5 %	-1.3 %	1909	7	-26.2 %
	1913	4	23.1 %	-2.4 %	-0.5 %	10.5 %	3.5 %	4.7 %	-5.1 %	9.1 %	3.0 %	28.1 %	5.6 %	1918	5	28.1 %
	1928	10	30.9 %	7.7 %	1.5 %	11.4 %	3.8 %	20.4 %	-5.2 %	-29.6 %	-9.9 %	-33.8 %	-6.8 %	1932	4	-56.7 %
	1934	2	236.4 %	53.7 %	10.7 %	107.1 %	35.7 %	120.1 %	-67.1 %	-71.3 %	-23.8 %	-54.7 %	-10.9 %	1937	3	-71.3 %
	1939	2	57.7 %	-54.7 %	-10.9 %	80.0 %	26.7 %	15.6 %	-14.3 %	2.4 %	0.8 %	8.5 %	1.7 %	1943	4	-18.5 %
	1949	6	125.0 %	69.0 %	13.8 %	44.8 %	14.9 %	85.0 %	-35.3 %	-24.8 %	-8.3 %	-46.4 %	-9.3 %	1954	5	-46.4 %
	1964	10	348.1 %	135.1 %	27.0 %	60.6 %	20.2 %	33.9 %	-3.3 %	-1.4 %	-0.5 %	-0.4 %	-0.1 %	1966	2	-3.3 %
	1968	2	5.9 %	37.2 %	7.4 %	5.9 %	2.0 %	3.9 %	-2.8 %	6.5 %	2.2 %	29.9 %	6.0 %	1972	4	14.0 %
	1978	6	195.4 %	159.3 %	31.9 %	93.8 %	31.3 %	7.9 %	-5.8 %	-22.8 %	-7.6 %	-28.5 %	-5.7 %	1985	7	-29.5 %
	2007	22	293.6 %	19.9 %	4.0 %	13.5 %	4.5 %	2.8 %	-5.4 %	-6.1 %	-2.0 %	-6.1 % ¤	-2.0 %			

Australia														1883	3	2.5 %
	1889	6	38.7 %	19.6 %	3.9 %	17.7 %	5.9 %	13.0 %	-8.4 %	-15.0 %	-5.0 %	-44.7 %	-8.9 %	1894	5	-44.7 %
	1902	8	28.8 %	13.4 %	2.7 %	24.8 %	8.3 %	3.2 %	-8.1 %	-11.8 %	-3.9 %	0.6 %	0.1 %	1905	3	-11.8 %
	1908	3	18.3 %	13.5 %	2.7 %	18.3 %	6.1 %	3.7 %	3.0 %	7.1 %	2.4 %	25.0 %	5.0 %	1911	3	7.1 %
	1913	2	16.7 %	25.0 %	5.0 %	20.0 %	6.7 %	3.4 %	2.9 %	3.8 %	1.3 %	23.3 %	4.7 %	1917	4	8.6 %
	1924	7	63.6 %	35.1 %	7.0 %	12.7 %	4.2 %	2.5 %	-1.9 %	-4.0 %	-1.3 %	1.1 %	0.2 %	1930	6	-14.5 %
	1937	7	-2.2 %	13.5 %	2.7 %	9.5 %	3.2 %	4.0 %	1.0 %	9.9 %	3.3 %	30.4 %	6.1 %	1939	2	3.2 %
	1942	3	26.4 %	30.4 %	6.1 %	26.4 %	8.8 %	10.0 %	0.7 %	-1.7 %	-0.6 %	-1.7 %	-0.3 %	1949	7	-5.2 %
	1951	2	177.5 %	167.8 %	33.6 %	191.8 %	63.9 %	19.4 %	-0.6 %	-2.4 %	-0.8 %	21.8 %	4.4 %	1953	2	-8.6 %
	1974	21	479.5 %	109.1 %	21.8 %	65.6 %	21.9 %	21.4 %	9.9 %	33.0 %	11.0 %	53.0 %	10.6 %	1979	5	53.0 %
	1981	2	40.1 %	76.3 %	15.3 %	52.1 %	17.4 %	15.0 %	2.7 %	24.8 %	8.3 %	47.2 %	9.4 %	1983	2	9.0 %
	1989	6	137.0 %	106.9 %	21.4 %	75.4 %	25.1 %	37.4 %	-0.6 %	-1.0 %	-0.3 %	4.4 %	0.9 %	1993	4	0.4 %
	2004	11	144.7 %	78.5 %	15.7 %	45.4 %	15.1 %	4.5 %	-0.6 %	10.4 %	3.5 %	19.3 %	3.9 %	2006	2	2.1 %
France														1941	5	25.7 %
	1943	2	100.0 %	116.2 %	23.2 %	114.5 %	38.2 %	49.3 %	18.1 %	59.9 %	20.0 %	144.2 %	28.8 %	1948	5	144.2 %
	1980	32	9772.2 %	102.1 %	20.4 %	51.4 %	17.1 %	19.8 %	11.0 %	23.2 %	7.7 %	32.3 %	6.5 %	1985	5	32.3 %
	1991	6	59.3 %	52.2 %	10.4 %	28.3 %	9.4 %	5.2 %	-2.4 %	-4.0 %	-1.3 %	-4.0 %	-0.8 %	1996	5	-4.0 %
	2007	11	148.3 %	77.3 %	15.5 %	37.8 %	12.6 %	6.6 %	1.2 %	0.0 %	0.0 %	0.0 % ¤	0.0 %			
Norway	1859	9	103.5 %	53.1 %	10.6 %	24.6 %	8.2 %	20.0 %	-15.0 %	-18.5 %	-6.2 %	-26.0 %	-5.2 %	1868	9	-11.5 %
	1878	10	97.0 %	43.6 %	8.7 %	17.7 %	5.9 %	8.5 %	-12.9 %	-13.8 %	-4.6 %	-13.0 %	-2.6 %	1880	2	-18.0 %
	1887	7	6.6 %	-1.9 %	-0.4 %	10.3 %	3.4 %	6.4 %	-3.7 %	1.3 %	0.4 %	13.0 %	2.6 %	1889	2	-5.8 %
	1898	9	61.7 %	20.7 %	4.1 %	20.3 %	6.8 %	10.2 %	3.4 %	-12.1 %	-4.0 %	-10.4 %	-2.1 %	1900	2	-9.1 %
	1902	2	-0.4 %	-0.3 %	-0.1 %	-12.4 %	-4.1 %	3.0 %	-1.0 %	-14.9 %	-5.0 %	-8.8 %	-1.8 %	1907	5	-8.8 %
	1910	3	10.3 %	18.1 %	3.6 %	10.3 %	3.4 %	8.4 %	1.7 %	12.6 %	4.2 %	17.3 %	3.5 %	1912	2	6.9 %
	1914	2	12.7 %	30.6 %	6.1 %	18.5 %	6.2 %	7.1 %	-2.6 %	27.3 %	9.1 %	55.9 %	11.2 %	1921	7	44.2 %
	1933	12	1.0 %	0.5 %	0.1 %	3.9 %	1.3 %	1.5 %	-5.8 %	2.8 %	0.9 %	3.9 %	0.8 %	1935	2	-6.0 %
	1939	4	19.7 %	19.4 %	3.9 %	9.4 %	3.1 %	8.2 %	0.4 %	0.2 %	0.1 %	-0.3 %	-0.1 %	1944	5	-0.3 %
	1949	5	16.2 %	16.2 %	3.2 %	8.7 %	2.9 %	5.9 %	2.2 %	2.5 %	0.8 %	-0.4 %	-0.1 %	1954	5	-0.4 %
	1972	18	231.5 %	51.4 %	10.3 %	34.0 %	11.3 %	12.7 %	5.0 %	21.4 %	7.1 %	50.5 %	10.1 %	1976	4	25.5 %
	1987	11	387.9 %	95.8 %	19.2 %	71.4 %	23.8 %	23.1 %	-0.4 %	-17.4 %	-5.8 %	-30.1 %	-6.0 %	1992	5	-30.1 %
Paris														1855	5	26.3 %

	1859	4	40.8 %	44.4 %		8.9 %	28.8 %	9.6 %	9.1 %	-0.8 %	-1.8 %	-0.6 %	0.0 %	0.0 %	1861	2	-2.7 %
	1869	8	36.6 %	32.9 %		6.6 %	15.6 %	5.2 %	4.4 %	-6.3 %	-16.3 %	-5.4 %	-28.3 %	-5.7 %	1874	5	-28.3 %
	1889	15	52.0 %	3.3 %		0.7 %	4.6 %	1.5 %	4.6 %	1.3 %	1.3 %	0.4 %	2.0 %	0.4 %	1891	2	1.3 %
	1893	2	3.2 %	9.4 %		1.9 %	3.2 %	1.1 %	3.2 %	-2.4 %	-5.5 %	-1.8 %	-3.1 %	-0.6 %	1895	2	-6.2 %
	1906	11	15.2 %	1.8 %		0.4 %	-0.5 %	-0.2 %	1.2 %	1.1 %	4.5 %	1.5 %	13.1 %	2.6 %	1908	2	2.3 %
	1910	2	7.2 %	10.9 %		2.2 %	8.5 %	2.8 %	4.9 %	3.1 %	5.2 %	1.7 %	14.3 %	2.9 %	1912	2	4.2 %
	1914	2	4.0 %	13.6 %		2.7 %	5.0 %	1.7 %	3.0 %	5.5 %	11.5 %	3.8 %	9.7 %	1.9 %	1920	6	8.8 %
	1935	15	147.9 %	2.5 %		0.5 %	-7.6 %	-2.5 %	-5.2 %	-4.4 %	-7.0 %	-2.3 %	8.2 %	1.6 %	1940	5	8.2 %
	1942	2	44.9 %	67.9 %		13.6 %	63.2 %	21.1 %	21.9 %	8.0 %	19.3 %	6.4 %	42.7 %	8.5 %	1950	8	86.8 %
	1969	19	4667.3 %	64.3 %		12.9 %	27.8 %	9.3 %	14.5 %	3.8 %	19.9 %	6.6 %	55.8 %	11.2 %	1975	6	67.6 %
	1981	6	105.8 %	78.3 %		15.7 %	53.0 %	17.7 %	13.8 %	2.2 %	13.5 %	4.5 %	40.4 %	8.1 %	1984	3	13.5 %
	1990	6	158.3 %	133.4 %		26.7 %	78.4 %	26.1 %	17.6 %	1.6 %	-14.8 %	-4.9 %	-21.2 %	-4.2 %	1997	7	-30.2 %
Sweden	1887	12	32.5 %	8.7 %		1.7 %	-0.6 %	-0.2 %	0.7 %	-0.6 %	0.5 %	0.2 %	0.2 %	0.0 %	1891	4	1.4 %
	1896	5	2.2 %	2.2 %		0.4 %	0.9 %	0.3 %	1.3 %	2.4 %	10.1 %	3.4 %	14.5 %	2.9 %	1899	3	10.1 %
	1906	7	21.1 %	16.4 %		3.3 %	11.6 %	3.9 %	6.1 %	2.2 %	2.4 %	0.8 %	3.8 %	0.8 %	1919	13	33.9 %
	1931	12	25.6 %	4.7 %		0.9 %	3.4 %	1.1 %	1.4 %	-3.7 %	-9.2 %	-3.1 %	-5.3 %	-1.1 %	1937	6	-10.1 %
	1939	2	10.4 %	9.3 %		1.9 %	4.8 %	1.6 %	5.8 %	-3.8 %	-4.6 %	-1.5 %	4.6 %	0.9 %	1942	3	-4.6 %
	1947	5	36.3 %	36.3 %		7.3 %	24.3 %	8.1 %	11.6 %	-4.7 %	-5.7 %	-1.9 %	-0.7 %	-0.1 %	1958	11	12.9 %
	1965	7	53.1 %	42.8 %		8.6 %	26.2 %	8.7 %	11.5 %	6.1 %	9.4 %	3.1 %	17.4 %	3.5 %	1974	9	34.9 %
	1979	5	87.3 %	87.3 %		17.5 %	40.6 %	13.5 %	10.9 %	5.5 %	15.6 %	5.2 %	27.3 %	5.5 %	1984	5	27.3 %
	1990	6	145.0 %	123.7 %		24.7 %	70.7 %	23.6 %	19.2 %	0.1 %	-25.3 %	-8.4 %	-19.1 %	-3.8 %	1993	3	-25.3 %
UK															1934	4	-12.7 %
	1936	2	6.8 %	-8.3 %		-1.7 %	3.8 %	1.3 %	3.8 %	-1.8 %	-0.9 %	-0.3 %	-0.9 %	-0.2 %	1945	9	-0.9 %
	1947	2	234.6 %	234.6 %		46.9 %	234.6 %	78.2 %	25.0 %	-4.0 %	6.4 %	2.1 %	11.2 %	2.2 %	1954	7	8.0 %
	1956	2	15.7 %	7.8 %		1.6 %	13.7 %	4.6 %	10.5 %	2.2 %	5.7 %	1.9 %	21.5 %	4.3 %	1958	2	4.8 %
	1973	15	316.0 %	128.9 %		25.8 %	99.8 %	33.3 %	34.8 %	10.5 %	27.8 %	9.3 %	56.8 %	11.4 %	1977	4	37.3 %
	1980	3	72.9 %	100.2 %		20.0 %	72.9 %	24.3 %	18.4 %	2.5 %	12.2 %	4.1 %	31.8 %	6.4 %	1982	2	0.2 %
	1989	7	132.0 %	88.4 %		17.7 %	51.2 %	17.1 %	11.1 %	9.0 %	11.8 %	3.9 %	18.1 %	3.6 %	1995	6	19.7 %
USA	1894	4	11.6 %	11.6 %	*	2.9 %	23.7 %	7.9 %	16.5 %	-9.2 %	-18.9 %	-6.3 %	-17.4 %	-3.5 %	1896	2	-21.3 %
	1898	2	9.9 %	0.7 %		0.1 %	-4.8 %	-1.6 %	6.5 %	-4.4 %	-8.3 %	-2.8 %	9.8 %	2.0 %	1905	7	0.7 %
	1907	2	30.9 %	21.9 %		4.4 %	14.7 %	4.9 %	10.3 %	-9.8 %	-4.7 %	-1.6 %	-3.3 %	-0.7 %	1910	3	-4.7 %

1912	2	1.5 %	-3.3 %	-0.7 %	9.6 %	3.2 %	3.9 %	0.0 %	-4.8 %	-1.6 %	6.4 %	1.3 %	1921	9	33.3 %
1925	4	8.5 %	6.0 %	1.2 %	7.0 %	2.3 %	5.2 %	-4.0 %	-6.2 %	-2.1 %	-12.1 %	-2.4 %	1932	7	-27.7 %
1940	8	16.3 %	7.0 %	1.4 %	1.1 %	0.4 %	3.3 %	-8.4 %	5.5 %	1.8 %	37.5 %	7.5 %	1942	2	-5.3 %
1947	5	118.6 %	118.6 %	23.7 %	68.2 %	22.7 %	21.3 %	2.1 %	5.9 %	2.0 %	17.2 %	3.4 %	1949	2	2.1 %
1955	6	29.3 %	24.8 %	5.0 %	12.7 %	4.2 %	1.0 %	-0.3 %	3.7 %	1.2 %	4.7 %	0.9 %	1963	8	6.6 %
1965	2	4.0 %	5.9 %	1.2 %	4.3 %	1.4 %	1.9 %	1.3 %	4.5 %	1.5 %	17.7 %	3.5 %	1968	3	4.5 %
1972	4	26.2 %	29.0 %	5.8 %	20.5 %	6.8 %	4.3 %	2.4 %	18.8 %	6.3 %	36.1 %	7.2 %	1976	4	25.2 %
1979	3	45.0 %	69.6 %	13.9 %	45.0 %	15.0 %	16.2 %	12.8 %	26.7 %	8.9 %	33.8 %	6.8 %	1983	4	27.8 %
1989	6	49.5 %	42.9 %	8.6 %	26.6 %	8.9 %	7.3 %	3.9 %	2.8 %	0.9 %	6.2 %	1.2 %	1997	8	13.5 %
2006	9	116.4 %	65.6 %	13.1 %	41.7 %	13.9 %	12.9 %	1.1 %	-17.4 %	-5.8 %	-23.1 %	-4.6 %	2012	6	-25.8 %