Technical Analysis of the Nasdaq-100 Index and Financial Analysis of its Constituent Companies

by

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ABSTRACT

The purpose of this thesis is to evaluate the Nasdaq-100 as an investment option and to provide the most reliable technical analysis indicators for this particular index.

The Nasdaq-100 is a stock market index which consists of 103 equity securities issued by 100 of the largest publicly-traded companies in the United States that are listed on the Nasdaq stock market, excluding the financial sector. To evaluate the Nasdaq-100 as an investment option, a financial analysis was performed on twenty of the largest companies that this index features. During this analysis, the financial indicators for solvency, performance and performance-management were calculated from 2016 to 2019. The sub-total of these twenty companies constitutes almost 70% of the capital contained in this index. Therefore, the performance of these companies as an average should mirror the performance of the Nasdaq-100.

Technical analysis indicators are mathematical calculations that aim to predict the future price movement of an asset by analyzing the past performance of its price or volume. A technical analysis was performed on the Nasdaq-100 from 2016 to 2019 in order to determine the most reliable technical indicators who can successfully predict future prices for this index. The calculated technical indicators were momentum oscillators and trend indicators. These indicators were calculated daily for the selected time period of the analysis, based on the daily price movement of the Nasdaq-100. In this thesis, the chosen indicators were assessed individually in daily, weekly and monthly periods. For every indicator and for each one of the three time periods, an investment in the Nasdaq-100 was simulated based on the BUY and SELL signals calculated by the indicators. Two different scenarios were examined; one with 0% commission per transaction and one with 1.5%. The results show the combinations of indicators and time periods that produce the best investment returns for each one of the two scenarios.

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Τεχνική Ανάλυση του Δείκτη Nasdaq-100 και
Χρηματοοικονομική Ανάλυση των Εισηγμένων του
Εταιριών

του

Δημητρίου Σ. Χαρίτου

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Μηχανικού Παραγωγής και Διοίκησης

1. ΣΤΟΧΟΣ ΕΡΓΑΣΙΑΣ

Αυτή η διπλωματική εργασία στοχεύει στην αξιολόγηση του Nasdaq-100 ως επενδυτική επιλογή και στην εύρεση των πιο αξιόπιστων δεικτών τεχνικής ανάλυσης προκειμένου μία τέτοια επένδυση να αποφέρει τα μέγιστα δυνατά κέρδη. Πιο συγκεκριμένα θα εξεταστούν:

- Αν ο δείκτης Nasdaq-100 διαθέτει υγιείς εταιρείες με αναπτυξιακό δυναμικό και καινοτόμο χαρακτήρα
- Ποιοι είναι οι πιο ακριβείς αριθμοδείκτες τεχνικής ανάλυσης που πρέπει να ληφθούν υπόψη κατά την επένδυση στον δείκτη Nasdaq-100 χωρίς κάποια προμήθεια;
- Ποιοι είναι οι πιο ακριβείς αριθμοδείκτες τεχνικής ανάλυσης που πρέπει να ληφθούν υπόψη όταν γίνεται μία επένδυση στο δείκτη Nasdaq-100 με προμήθεια ανά συναλλαγή;

2. Ο ΔΕΙΚΤΗΣ NASDAQ-100

Ο Nasdaq-100 είναι ένας δείκτης χρηματιστηρίου που αποτελείται από 103 μετοχικούς τίτλους που εκδίδονται από τις εκατό μεγαλύτερες εταιρείες στις Ηνωμένες Πολιτείες που είναι εισηγμένες στο χρηματιστήριο Nasdaq, εξαιρουμένου του χρηματοπιστωτικού τομέα. Διαθέτει μερικές από τις μεγαλύτερες εταιρείες στον κόσμο συμπεριλαμβανομένων και τεσσάρων στις ΗΠΑ που έχουν ξεπεράσει τα ένα τρισεκατομμύριο δολάρια σε αξία. Ως δείκτης, η αξία του Nasdaq-100 δεν εξαρτάται από μια μεμονωμένη εταιρεία, πράγμα που τον καθιστά μία επένδυση χαμηλού κινδύνου. Επιπλέον, αποτελεί μια καλά διαφοροποιημένη επιλογή για επενδυτές καθώς οι εταιρείες που είναι εισηγμένες σε αυτόν δεν ανήκουν όλες στον ίδιο τομέα.

3. ΧΡΗΜΑΤΟΟΙΚΟΝΟΜΙΚΗ ΑΝΑΛΥΣΗ ΕΤΑΙΡΙΩΝ ΤΟΥ NASDAQ-100

Προκειμένου να αξιολογηθεί ο Nasdaq-100 ως επενδυτική επιλογή πρέπει να εξεταστούν οι εταιρείες που έχουν εισηγηθεί σε αυτόν. Ωστόσο, οι εταιρίες αυτές αλλάζουν κάθε τρίμηνο αναλόγως με την εκάστοτε αξία τους ώστε να είναι πάντα οι εκατό μεγαλύτερες του χρηματιστηρίου Nasdaq. Συνεπώς, με βάση τα στοιχεία που παρουσιάστηκαν στις 20 Μαρτίου του 2020 επιλέχθηκε ένα υποσύνολο των είκοσι μεγαλύτερων εταιριών του Nasdaq-100 (Microsoft Corp, Apple Inc, Amazon.com Inc, Alphabet Inc, Facebook Inc, Intel Corp, Comcast Corp, Cisco Systems Inc, Netflix Inc, PepsiCo Inc, Adobe Inc, Costco Wholesale Inc, NVIDIA Corp, Amgen Inc, PayPal Holdings Inc, Gilead Sciences Inc, Texas Instruments Inc, Charter Communications Inc, Tesla

Inc, Broadcom Inc) στο οποίο πραγματοποιήθηκε χρηματοοικονομική ανάλυση από το 2016 έως το 2019.

Για αυτά τα τέσσερα χρόνια και για κάθε μία από τις επιλεγμένες επιχειρήσεις υπολογίστηκαν συγκεκριμένοι αριθμοδείκτες χρηματοοικονομικής ανάλυσης οι οποίοι περιγράφουν δυναμικά όλες τις χρηματοοικονομικές δραστηριότητες των εταιρειών και μετρούν αποτελεσματικά την κερδοφορία τους. Οι πιο σημαντικές κατηγορίες αριθμοδεικτών που συμπεριλήφθηκαν στις χρηματοοικονομικές αναλύσεις που πραγματοποιήθηκαν είναι οι ακόλουθες:

- Αριθμοδείκτες Φερεγγυότητας (Δείκτης Συνολικής Ικανότητας Δανεισμού, Δείκτης Μακροπρόθεσμης Ικανότητας Δανεισμού, Δείκτης Γενικής Ρευστότητας, Δείκτης Άμεσης Ρευστότητας, Δείκτης Κεφαλαίου Κίνησης, Δείκτης Κάλυψης Τόκων, Δείκτης Χρηματοοικονομικής Μόχλευσης)
- Αριθμοδείκτες Αποδοτικότητας (Καθαρό Περιθώριο Κέρδους, Χρηματοοικονομική Αποδοτικότητα, Δείκτης Αποδοτικότητας Ενεργητικού, Δείκτης Μικτού Κέρδους, Δείκτης Ταχύτητας Κυκλοφορίας Ενεργητικού)
- Αριθμοδείκτες Επίδοσης Διαχείρισης (Δείκτης Σημασίας Χρηματοοικονομικών Εξόδων, Δείκτης Σημασίας Γενικών και Διοικητικών Εξόδων)

Οι χρηματοοικονομικοί αριθμοδείκτες υπολογίζονται μαθηματικά με τη μορφή ενός κλάσματος που αποτελείται από χρηματοοικονομικά δεδομένα που μπορούν να συσχετιστούν αποτελεσματικά. Τα δεδομένα αυτά συμπεριλαμβάνονται στις οικονομικές καταστάσεις των εξεταζόμενων εταιρειών, όπως οι καταστάσεις αποτελεσμάτων χρήσης και οι ισολογισμοί (τα οποία είναι δημοσίως διαθέσιμα).

Οι εταιρίες που επιλέχθηκαν αποτελούν το 71,04% του συνολικού κεφαλαίου που περιέχεται στον Nasdaq-100 και επομένως τα συμπεράσματα της χρηματοοικονομικής τους ανάλυσης θα πρέπει σαν μέσο όρο να αντικατοπτρίζουν την αντίστοιχη εικόνα του δείκτη. Ταυτόχρονα, η κεφαλαιοποίησης αγοράς μιας εταιρείας είναι άμεσα ανάλογη με την επίδρασή της στον δείκτη, πράγμα που σημαίνει ότι ορισμένες εταιρείες έχουν μεγαλύτερη επιρροή στην αξία του Nasdaq-100 από άλλες. Είναι επομένως ασφαλές να υποθέσουμε ότι ένας απλός μέσος όρος είκοσι εταιρειών για κάθε αριθμοδείκτη χρηματοοικονομικής ανάλυσης μπορεί να μην είναι αρκετός για να παράγει αξιόπιστα αποτελέσματα. Για να επιλυθεί αυτό το πρόβλημα, σε κάθε εταιρεία εκχωρήθηκε ένας συντελεστής βάρους που εκφράζει το ποσοστό της στη συνολική κεφαλαιοποίηση αγοράς του Nasdaq-100. Στη συνέχεια, αυτός ο συντελεστής προσαρμόστηκε στο επιλεγμένο υποσύνολο των είκοσι εταιρειών ώστε να εκφράζει το ποσοστό της κάθε εταιρίας στη κεφαλαιοποίηση αγοράς του υποσυνόλου. Τα αποτελέσματα της χρηματοοικονομικής ανάλυσης καθώς και τα συμπεράσματα για τον Nasdaq-100 αναλύονται παρακάτω.

Μέσοι Όροι Αριθμοδεικτών Υποσυνόλου NASDAQ-100	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Αριθμοδείκτες Φερεγγυότητας				
Δείκτης Συνολικής Ικανότητας Δανεισμού	0.5983	0.5880	0.5803	0.5450
Δείκτης Μακροπρόθεσμης Ικανότητας Δανεισμού	0.5335	0.5381	0.5382	0.5978
Δείκτης Γενικής Ρευστότητας	2.1110	2.4429	3.0103	2.8899
Δείκτης Άμεσης Ρευστότητας	1.9865	2.3045	2.8769	2.7787
Δείκτης Κεφαλαίου Κίνησης	2.2728	2.6673	2.6387	2.4268
Δείκτης Κάλυψης Τόκων	122.62	202.55	233.59	108.16
Δείκτης Χρηματοοικονομικής Μόχλευσης	2.9923	2.9789	3.0478	2.7412
Αριθμοδείκτες Αποδοτικότητας				
Καθαρό Περιθώριο Κέρδους	0.1951	0.1858	0.1637	0.1682
Χρηματοοικονομική Αποδοτικότητα	0.3200	0.3002	0.2148	0.2147
Δείκτης Αποδοτικότητας Ενεργητικού	0.1145	0.1155	0.0867	0.0931

Δείκτης Μικτού Κέρδους	0.5193	0.5206	0.5164	0.5163
Δείκτης Ταχύτητας Κυκλοφορίας Ενεργητικού	0.7361	0.7637	0.7072	0.7597
Αριθμοδείκτες Επίδοσης Διαχείρισης				
Δείκτης Σημασίας Χρηματοοικονομικών Εξόδων	0.0143	0.0142	0.0132	0.0108
Δείκτης Σημασίας Γενικών και Διοικητικών Εξόδων	0.1624	0.1569	0.1606	0.1660

Ο Δείκτης Συνολικής Ικανότητας Δανεισμού του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη δεν επιβαρύνονται με δάνεια και άλλες υποχρεώσεις έναντι τρίτων.

Ο Δείκτης Μακροπρόθεσμης Ικανότητας Δανεισμού του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη έχουν ελάχιστες μακροπρόθεσμες υποχρεώσεις σε σύγκριση με τα ίδια κεφάλαιά τους.

Ο Δείκτης Γενικής Ρευστότητας του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη θα μπορούσαν να αποπληρώσουν τις διπλάσιες από τις τρέχουσες υποχρεώσεις τους σε περίπτωση που ρευστοποιηθούν.

Ο Δείκτης Άμεσης Ρευστότητας του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι υποχρεώσεις των εταιρειών που αναφέρονται σε αυτόν τον δείκτη μπορούν να καλυφθούν εξολοκλήρου από τα στοιχεία του ενεργητικού τους.

Ο Δείκτης Κεφαλαίου Κίνησης του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι τα περιουσιακά στοιχεία των εταιρειών αυτού του δείκτη προέρχονται εξ ολοκλήρου από πάγια κεφάλαια (άθροισμα ιδίων κεφαλαίων και μη βραχυπρόθεσμων υποχρεώσεων).

Ο Δείκτης Κάλυψης Τόκων του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη μπορούν να εξοφλήσουν τους τόκους ξένων κεφαλαίων από τα κέρδη τους με μεγάλη ευκολία.

Ο Δείκτης Χρηματοοικονομικής Μόχλευσης του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη χρησιμοποιούν αποτελεσματικά τα δανεισμένα κεφάλαια για να αποφέρουν κέρδη.

Το Καθαρό Περιθώριο Κέρδους έχει μέτριες τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου. Ωστόσο, υπάρχει μια θετική πρόοδος από το 2016 έως το 2019 με την τελική τιμή του 19,51% να είναι πολύ κοντά στο 20% που θεωρείται εξαιρετική. Το Nasdaq-100 είναι επίσης ένας δείκτης που βασίζεται στην τεχνολογία και ο κλάδος της τεχνολογίας επιτρέπει χαμηλότερες τιμές αυτού του αριθμοδείκτη λόγω της ανάγκης για αρχικές επενδύσεις που απαιτούνται για την ανάπτυξη λογισμικού. Επομένως, και σύμφωνα με τις διεθνείς νόρμες, οι τιμές αυτού του δείκτη δείχνουν ότι οι εταιρείες του Nasdaq-100 κρατούν ένα υψηλό ποσοστό από κάθε δολάριο που παράγουν.

Η Χρηματοοικονομική Αποδοτικότητα του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες που είναι εισηγμένες σε αυτόν τον δείκτη χρησιμοποιούν επιτυχώς τα μετοχικά τους κεφάλαια προκειμένου να αναπτύξουν κέρδη.

Ο Δείκτης Αποδοτικότητας Ενεργητικού του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη έχουν τη δυνατότητα να παράγουν υψηλά κέρδη σε σύγκριση με τα περιουσιακά τους στοιχεία.

Ο Δείκτης Μικτού Κέρδους του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη διαθέτουν αποδοτικότητα λειτουργίας και χρησιμοποιούν αποτελεσματικές πολιτικές τιμολόγησης.

Ο Δείκτης Ταχύτητας Κυκλοφορίας Ενεργητικού του Nasdaq-100 έχει μη ικανοποιητικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι υπάρχει υπερβολική επένδυση κεφαλαίου στις εταιρείες που αναφέρονται σε αυτόν τον δείκτη σε σχέση με τα έσοδά τους. Επιπλέον, υπάρχει μια αρνητική πρόοδος από το 2016 έως το 2019. Ωστόσο, αυτός ο δείκτης περιλαμβάνει μερικές από τις μεγαλύτερες εταιρείες στον κόσμο, με κεφαλαιοποιήσεις αγορών μεγαλύτερες του $1 τρισεκατομμυρίου. Επομένως είναι λογικό τα ετήσια έσοδα αυτών των εταιρειών να επισκιάζονται από το συνολικό ενεργητικό τους.

Ο Δείκτης Σημασίας Χρηματοοικονομικών Εξόδων του Nasdaq-100 έχει εξαιρετικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες που είναι εισηγμένες σε αυτόν τον δείκτη έχουν σημαντικά μεγαλύτερα έσοδα σε σύγκριση με τα έξοδά τους.

Ο Δείκτης Σημασίας Γενικών & Διοικητικών Εξόδων του Nasdaq-100 έχει μη ικανοποιητικές τιμές κατά τη διάρκεια της εξεταζόμενης χρονικής περιόδου, πράγμα που σημαίνει ότι οι εταιρείες αυτού του δείκτη έχουν σημαντικά γενικά και διοικητικά έξοδα. Επιπλέον, παρά τη θετική πρόοδο από το 2016 έως το 2019 και την τελική αξία του 16,24%, αυτά τα έξοδα είναι πάνω από τρεις φορές υψηλότερα από το μέγιστο του 5% που υποδεικνύουν οι διεθνείς νόρμες. Ωστόσο, η τεχνολογική φύση και η τεράστια κεφαλαιοποίηση αγοράς των περισσότερων εταιρειών που είναι εισηγμένες στο Nasdaq-100 θα μπορούσαν να είναι υπεύθυνες για μια τέτοια απόκλιση.

4. ΤΕΧΝΙΚΗ ΑΝΑΛΥΣΗ ΤΟΥ NASDAQ-100

Για να εκτελεστεί μία συναλλαγή την καλύτερη δυνατή στιγμή και να προσκομίσει τα μέγιστα κέρδη, οι επενδυτές μπορούν να χρησιμοποιήσουν αριθμοδείκτες τεχνικής ανάλυσης. Αυτοί οι αριθμοδείκτες δεν εξετάζουν κανένα μέρος της βασικής επιχείρησης, όπως έσοδα, κέρδη ή περιθώρια κέρδους. Είναι μαθηματικοί υπολογισμοί που στοχεύουν στην πρόβλεψη της μελλοντικής μεταβολής των τιμών ενός περιουσιακού στοιχείου, αναλύοντας την προηγούμενη πορεία της τιμής ή του όγκου του. Οι τεχνικοί αριθμοδείκτες έχουν σχεδιαστεί κυρίως για να αναλύουν τις βραχυπρόθεσμες μεταβολές των τιμών και, ως εκ τούτου, χρησιμοποιούνται κυρίως από βραχυπρόθεσμους επενδυτές και όχι από μακροπρόθεσμους. Οι κύριες κατηγορίες αριθμοδεικτών τεχνικής ανάλυσης είναι οι ακόλουθες:

- Ταλαντωτές Ορμής
- Αριθμοδείκτες Τάσης
- Αριθμοδείκτες Μεταβλητότητας
- Αριθμοδείκτες Όγκου

Πραγματοποιήθηκε τεχνική ανάλυση στον Nasdaq-100 από το 2016 έως το 2019, προκειμένου να προσδιοριστούν οι πιο αξιόπιστοι τεχνικοί αριθμοδείκτες που μπορούν να προβλέψουν με επιτυχία τις μελλοντικές τιμές για αυτόν τον δείκτη. Οι κατηγορίες αριθμοδεικτών που επιλέχθηκαν να

συμπεριληφθούν σε αυτήν την ανάλυση ήταν οι ταλαντωτές ορμής και οι αριθμοδείκτες τάσης. Πιο συγκεκριμένα:

- Ταλαντωτές Ορμής (RSI, STOCH, Williams %R, CCI, ULTOSC, ROC)
- Αριθμοδείκτες Τάσης (SMA, EMA, MACD, ADX)

Οι αριθμοδείκτες μεταβλητότητας δεν συμπεριλήφθηκαν καθώς δεν παρέχουν σαφή σήματα αγοράς (Buy) και πώλησης (Sell). Επιπλέον, δεδομένου ότι οι δείκτες (π.χ. Nasdaq-100) μπορούν να συναλλάσσονται μόνο μέσω παραγώγων ή διαπραγματεύσιμων αμοιβαίων κεφαλαίων (ETFs) και όχι άμεσα, δεν υπάρχουν διαθέσιμα δεδομένα για τον όγκο συναλλαγών τους. Το τελευταίο καθιστά αδύνατη τη χρήση δεικτών όγκου.

Σε αυτήν την εργασία οι τεχνικοί αριθμοδείκτες αξιολογήθηκαν ξεχωριστά. Ωστόσο, για να επιτευχθούν τα καλύτερα αποτελέσματα, ένας έμπειρος επενδυτής θα συμβουλευτεί αρκετούς αριθμοδείκτες προτού εκτελέσει μία συναλλαγή. Συγκεκριμένα, όταν δείκτες διαφορετικών κατηγοριών προτείνουν την ίδια ενέργεια, υπάρχει πολύ μεγαλύτερη πιθανότητα η πρόβλεψή τους να πραγματοποιηθεί.

Οι αριθμοδείκτες τάσης δείχνουν μόνο σήματα αγοράς και πώλησης, οπότε ήταν αρκετά εύκολο να αξιολογηθούν. Ωστόσο, οι ταλαντωτές ορμής εμφανίζουν σήματα υπερβολικής προσφοράς (Overbought), αγοράς, πώλησης και υπερβολικής ζήτησης (Oversold). Κατά κανόνα, όταν ένα περιουσιακό στοιχείο είναι σε υπερβολική προσφορά, η αξία του αναμένεται να μειωθεί, ενώ όταν είναι υπερβολική ζήτηση, η τιμή του αναμένεται να αυξηθεί. Κατά συνέπεια, για όλους τους ταλαντωτές ορμής, τα σήματα υπερβολικής προσφοράς και ζήτησης μετατράπηκαν σε εντολές πώλησης and αγοράς αντίστοιχα.

Δεδομένου ότι ορισμένοι δείκτες μπορεί να είναι πιο αποτελεσματικοί στις βραχυπρόθεσμες επενδύσεις ενώ άλλοι σε μακροπρόθεσμες, η απόδοσή τους έπρεπε να εξεταστεί σε διαφορετικές χρονικές περιόδους. Με τα διαθέσιμα καθημερινά δεδομένα τιμών του Nasdaq-100, επιλέχθηκαν οι ακόλουθες χρονικές περίοδοι:

- Καθημερινή περίοδος (περίοδος μίας ημέρας)
- Εβδομαδιαία περίοδος (περίοδος πέντε ημερών)
- Μηνιαία περίοδος (Ανά μήνα από τον Ιανουάριο 2016 έως τον Δεκέμβριο 2019)

Επιπλέον, εξετάστηκαν δύο διαφορετικά σενάρια αναλόγως με το εάν η πλατφόρμα συναλλαγών απαιτεί προμήθεια. Ένα με προμήθεια 0% ανά συναλλαγή και ένα με 1,5% (οι προμήθειες κυμαίνονται συνήθως μεταξύ 1-2%).

Προκειμένου να συγκριθούν οι επιδόσεις όλων των επιλεγμένων αριθμοδεικτών τεχνικής ανάλυσης σε διαφορετικές χρονικές περιόδους, καθορίστηκαν ορισμένοι βασικές παράμετροι.

1. Μια εντολή αγοράς εκτελείται πάντα στην τιμή κλεισίματος της πρώτης διαθέσιμης περιόδου, ακόμη και αν ο δείκτης υποδηλώνει το αντίθετο. Αυτό συμβαίνει έτσι ώστε να δημιουργηθεί ένα κοινό σημείο εκκίνησης για όλους τους δείκτες.
2. Μια εντολή πώλησης εκτελείται πάντα στην τιμή κλεισίματος της τελευταίας περιόδου, ακόμη και αν ο δείκτης υποδηλώνει το αντίθετο. Αυτό αποφεύγεται μόνο εάν το περιουσιακό στοιχείο είχε πωληθεί πριν από την τελευταία περίοδο και δεν πραγματοποιήθηκαν άλλες αγορές μέχρι το τέλος.
3. Όλα τα ουδέτερα (Neutral) σήματα θεωρούνται ασαφή και κατά συνέπεια δεν εκτελούνται συναλλαγές σε αυτά.

4. Τα σήματα υπερβολικής προσφοράς (Overbought) και υπερβολικής ζήτησης (Oversold) μετατρέπονται σε σήματα πώλησης και αγοράς αντίστοιχα.

5. Δεν εκτελούνται ανοικτές πωλήσεις (Shorting) κατά τη διάρκεια αυτής της προσομοίωσης που σημαίνει ότι καμία εντολή πώλησης δεν θα εκτελεστεί χωρίς να έχει προηγηθεί εντολή αγοράς. Η ανοικτή πώληση είναι στρατηγική που χρησιμοποιούν οι επενδυτές για να στοιχηματίσουν κατά της αγοράς και να επωφεληθούν από τη μείωση της αξίας της. Αυτή η περίπλοκη μέθοδος εκτελεί την πώληση ενός περιουσιακού στοιχείου στην τρέχουσα τιμή με τη δέσμευση να αγοραστεί αυτό πίσω κάποια στιγμή στο μέλλον. Εάν η τιμή του στοιχείου πέσει, τότε η επαναγορά είναι φθηνότερη και δημιουργείται κέρδος.

6. Κατά τη διάρκεια οποιασδήποτε επένδυσης, το πλήρες διαθέσιμο ποσό κατατίθεται ή αποσύρεται που σημαίνει ότι οι παραγγελίες αγοράς και πώλησης πρέπει να εναλλάσσονται. Διαδοχικές παραγγελίες του ίδιου τύπου θα αγνοηθούν έως ότου επισημανθεί μια διαφορετική ένδειξη από τον εξεταζόμενο αριθμοδείκτη. Ένα παράδειγμα (χωρίς προμήθεια) φαίνεται στον παρακάτω πίνακα:

Ημερομηνία	Τιμή Κλεισίματος	Αξία Επένδυσης	Ένδειξη Αριθμοδείκτη	Συναλλαγές
10-01-2016	$23.00	$10,304.00	Πώληση	Εκτέλεση Πώλησης
09-01-2016	$25.00	$11,200.00	Αγορά	Εκτέλεση Αγοράς
08-01-2016	$20.00	$11,200.00	Πώληση	-
07-01-2016	$28.00	$11,200.00	Πώληση	Εκτέλεση Πώλησης
06-01-2016	$20.00	$10,000.00	Ουδέτερο	-
05-01-2016	$30.00	$10,000.00	Αγορά	-
04-01-2016	$25.00	$10,000.00	Αγορά	Εκτέλεση Αγοράς

7. Κάθε φορά που εκτελείται μια εντολή αγοράς, ο ακόλουθος τύπος υπολογίζει την τρέχουσα αξία της επένδυσης:

$$CVB = S - S \times C$$

όπου:
- **S**, αντιπροσωπεύει το πλήρες διαθέσιμο ποσό προς επένδυση
- **C**, αντιπροσωπεύει την προμήθεια ανά συναλλαγή
- **CVB**, αντιπροσωπεύει την τρέχουσα αξία της επένδυσης μετά την κατάθεση κεφαλαίων

8. Κάθε φορά που εκτελείται μια εντολή πώλησης, ο ακόλουθος τύπος υπολογίζει την τρέχουσα αξία της επένδυσης:

$$CVS = CVBL + \left(\frac{D - W}{W}\right) \times CVBL - \left(CVBL + \left(\frac{D - W}{W}\right) \times CVBL\right) \times C$$

όπου:
- **CVBL**, αντιπροσωπεύει την αξία που είχε η επένδυση μετά την τελευταία κατάθεση χρημάτων
- **D**, αντιπροσωπεύει την αξία του περιουσιακού στοιχείου τη στιγμή που είχε γίνει η κατάθεση
- **W**, αντιπροσωπεύει την αξία του περιουσιακού στοιχείου τη στιγμή που γίνεται η απόσυρση (τωρινή αξία)
- **C**, αντιπροσωπεύει την προμήθεια ανά συναλλαγή
- **CVS**, αντιπροσωπεύει την τρέχουσα αξία της επένδυσης μετά την απόσυρση κεφαλαίων

9. Το κέρδος ή η ζημία υπολογίζονται χρησιμοποιώντας την παρακάτω εξίσωση:

$$P/L(\%) = \frac{CVS(n) - A}{A} \times 100\%$$

όπου:
- **A**, αντιπροσωπεύει το αρχικό διαθέσιμο ποσό προς επένδυση
- **n**, αντιπροσωπεύει την τελική χρονική περίοδο
- **CVS(n)**, αντιπροσωπεύει την τρέχουσα αξία της επένδυσης μετά την απόσυρση κεφαλαίων την τελική χρονική περίοδο

Κατά τη διάρκεια της πρώτης προσομοίωσης, συνολικά 10.000,00 $ επενδύθηκαν στον Δείκτη Nasdaq-100 από το 2016 έως το 2019 χρησιμοποιώντας δεκαοκτώ διαφορετικούς αριθμοδείκτες ακολουθώντας τις προκαθορισμένες παραμέτρους. Κάθε συναλλαγή πραγματοποιήθηκε υπό ιδανικές συνθήκες που σημαίνει ότι όλες οι επενδύσεις ήταν χωρίς προμήθειες. Ορισμένες τιμές αριθμοδεικτών δεν ήταν δυνατό να αξιολογηθούν κάθε μήνα, επειδή δεν υπήρχαν αρκετά δεδομένα για την εκτέλεση των απαραίτητων υπολογισμών. Ο παρακάτω πίνακας απεικονίζει τους συνδυασμούς αριθμοδεικτών τεχνικής ανάλυσης και χρονικών περιόδων που αποφέρουν τα μεγαλύτερα κέρδη στην αρχική επένδυση.

Τεχνικοί Αριθμοδείκτες	Κατηγορία	Υψηλότερα Κέδη ανά Αριθμοδείκτη (%)		
		Κέρδος (%)	Χρονική Περίοδος	Συναλλαγές
ULTOSC	Ταλαντωτής Ορμής	104.08%	Μηνιαία	2
MACD (12,26)	Αριθμοδείκτης Τάσης	104.08%	Μηνιαία	2
SMA (200)	Αριθμοδείκτης Τάσης	103.87%	Εβδομαδιαία	2
EMA (200)	Αριθμοδείκτης Τάσης	103.87%	Εβδομαδιαία	2
ADX (14,14)	Αριθμοδείκτης Τάσης	99.50%	Μηνιαία	4
CCI (20)	Ταλαντωτής Ορμής	95.37%	Εβδομαδιαία	4
SMA (100)	Αριθμοδείκτης Τάσης	92.85%	Εβδομαδιαία	4
EMA (100)	Αριθμοδείκτης Τάσης	92.85%	Εβδομαδιαία	4
EMA (10)	Αριθμοδείκτης Τάσης	91.29%	Μηνιαία	6
EMA (50)	Αριθμοδείκτης Τάσης	90.17%	Εβδομαδιαία	8
SMA (20)	Αριθμοδείκτης Τάσης	87.04%	Μηνιαία	4
EMA (20)	Αριθμοδείκτης Τάσης	87.04%	Μηνιαία	4
SMA (10)	Αριθμοδείκτης Τάσης	86.15%	Μηνιαία	6
SMA (50)	Αριθμοδείκτης Τάσης	85.33%	Εβδομαδιαία	8
RSI (14)	Ταλαντωτής Ορμής	70.30%	Εβδομαδιαία	12
ROC (9)	Ταλαντωτής Ορμής	69.13%	Μηνιαία	6
STOCH (14,3,3)	Ταλαντωτής Ορμής	66.08%	Εβδομαδιαία	28
Williams %R (14)	Ταλαντωτής Ορμής	49.05%	Εβδομαδιαία	60

Κατά τη διάρκεια της δεύτερης προσομοίωσης, συνολικά 10.000,00 $ επενδύθηκαν στον Δείκτη Nasdaq-100 από το 2016 έως το 2019 χρησιμοποιώντας δεκαοκτώ διαφορετικούς αριθμοδείκτες ακολουθώντας τις προκαθορισμένες παραμέτρους. Κάθε συναλλαγή πραγματοποιήθηκε υπό πραγματικές συνθήκες που σημαίνει ότι όλες οι επενδύσεις είχαν προμήθεια 1,5% ανά συναλλαγή. Ορισμένες τιμές αριθμοδεικτών δεν ήταν δυνατό να αξιολογηθούν κάθε μήνα, επειδή δεν υπήρχαν αρκετά δεδομένα για την εκτέλεση των απαραίτητων υπολογισμών. Ο παρακάτω πίνακας

απεικονίζει τους συνδυασμούς αριθμοδεικτών τεχνικής ανάλυσης και χρονικών περιόδων που αποφέρουν τα μεγαλύτερα κέρδη στην αρχική επένδυση.

Τεχνικοί Αριθμοδείκτες	Κατηγορία	Υψηλότερα Κέδη ανά Αριθμοδείκτη (%)		
		Κέρδος (%)	Χρονική Περίοδος	Συναλλαγές
ULTOSC	Ταλαντωτής Ορμής	98.01%	Μηνιαία	2
MACD (12,26)	Αριθμοδείκτης Τάσης	98.01%	Μηνιαία	2
SMA (200)	Αριθμοδείκτης Τάσης	97.80%	Εβδομαδιαία	2
EMA (200)	Αριθμοδείκτης Τάσης	97.80%	Εβδομαδιαία	2
ADX (14,14)	Αριθμοδείκτης Τάσης	87.79%	Μηνιαία	4
CCI (20)	Ταλαντωτής Ορμής	83.91%	Εβδομαδιαία	4
SMA (100)	Αριθμοδείκτης Τάσης	81.53%	Εβδομαδιαία	4
EMA (100)	Αριθμοδείκτης Τάσης	81.53%	Εβδομαδιαία	4
SMA (20)	Αριθμοδείκτης Τάσης	76.07%	Μηνιαία	4
EMA (20)	Αριθμοδείκτης Τάσης	76.07%	Μηνιαία	4
EMA (10)	Αριθμοδείκτης Τάσης	74.71%	Μηνιαία	6
SMA (10)	Αριθμοδείκτης Τάσης	70.01%	Μηνιαία	6
EMA (50)	Αριθμοδείκτης Τάσης	68.51%	Εβδομαδιαία	8
SMA (50)	Αριθμοδείκτης Τάσης	64.22%	Εβδομαδιαία	8
ROC (9)	Ταλαντωτής Ορμής	54.46%	Μηνιαία	6
RSI (14)	Ταλαντωτής Ορμής	49.90%	Μηνιαία	4
STOCH (14,3,3)	Ταλαντωτής Ορμής	49.90%	Μηνιαία	6
Williams %R (14)	Ταλαντωτής Ορμής	18.44%	Μηνιαία	10

5. ΣΥΜΠΕΡΑΣΜΑΤΑ & ΠΡΟΤΑΣΕΙΣ

Η Χρηματοοικονομική Ανάλυση που πραγματοποιήθηκε στα είκοσι μεγαλύτερα στοιχεία του Nasdaq-100 από το 2016 έως το 2019 έδειξε ότι οι εταιρείες είναι εισηγμένες σε αυτόν τον δείκτη χαρακτηρίζονται από εξαιρετική φερεγγυότητα, υψηλή χρηματοοικονομική αποδοτικότητα και ικανότατη επίδοση διαχείρισης. Σχεδόν όλες οι τιμές των χρηματοοικονομικών δεικτών ήταν εξαιρετικές με μερικές εξαιρέσεις στις κατηγορίες χρηματοοικονομικής αποδοτικότητας και επίδοσης διαχείρισης. Ωστόσο, αυτές οι υποδεέστερες τιμές οφείλονται στην τεχνολογική φύση και την τεράστια κεφαλαιοποίησης αγοράς των περισσότερων εταιρειών που είναι εισηγμένες στο Nasdaq-100. Ως εκ τούτου, η Χρηματοοικονομική Ανάλυση κατέληξε στο συμπέρασμα ότι το Nasdaq-100 διαθέτει υγιείς εταιρείες με τεράστιο δυναμικό ανάπτυξης και συνεπώς οποιαδήποτε πιθανή επένδυση θα αποφέρει σίγουρα σημαντικά κέρδη.

Η τεχνική ανάλυση που πραγματοποιήθηκε στο Nasdaq-100 αξιολόγησε μεμονωμένα δεκαοκτώ διαφορετικούς αριθμοδείκτες προκειμένου να δείξει ποιοι θα μπορούσαν να προβλέψουν με μεγαλύτερη ακρίβεια τη μελλοντική μεταβολή των τιμών αυτού του δείκτη. Επιπλέον, εξετάστηκαν δύο διαφορετικά σενάρια ανάλογα με το εάν η πλατφόρμα συναλλαγών απαιτεί προμήθεια. Οι τρεις πρώτοι δείκτες, οι οποίοι ήταν ίδιοι και στα δύο σενάρια, είναι οι εξής:

1. ULTOSC (Ταλαντωτής Ορμής) παρατηρούμενος μηνιαία
2. MACD (Αριθμοδείκτης Τάσης) παρατηρούμενος μηνιαία
3. SMA 200 περιόδων (Αριθμοδείκτης Τάσης) παρατηρούμενος εβδομαδιαία

Και στα δύο σενάρια, αυτοί οι δείκτες διπλασιάζουν σχεδόν την αρχική επένδυση σε μόλις τέσσερα χρόνια, πράγμα που σημαίνει ότι παράγουν τετραπλάσιο κέρδος σε σχέση με το μέσο επιτόκιο δανεισμού των Ηνωμένων Πολιτειών εκείνη την χρονική περίοδο. Ωστόσο, οι έμπειροι επενδυτές θα χρησιμοποιούσαν μια ποικιλία δεικτών Τεχνικής Ανάλυσης για να εκτελέσουν μία συναλλαγή

όταν όλοι σηματοδοτούσαν την ίδια ενέργεια, με αποτέλεσμα ακόμα υψηλότερες αποδόσεις και μειωμένο αριθμό συναλλαγών (και άρα προμηθειών).

Τόσο οι χρηματοοικονομικές όσο και οι τεχνικές αναλύσεις καταλήγουν στο συμπέρασμα ότι μια επένδυση στο Nasdaq-100 χρησιμοποιώντας τα σωστά εργαλεία μπορεί να είναι πολύ κερδοφόρα. Προκειμένου να επιτευχθούν τα καλύτερα δυνατά αποτελέσματα, ένας επενδυτής πρέπει πάντα να τηρεί τα εξής:

- Διεξαγωγή Χρηματοοικονομικής Ανάλυσης σε εταιρίες ώστε να σχηματιστεί μια αξιόπιστη εικόνα για την απόδοση και τη διαχείρισή τους. Αυτά τα είδη δεδομένων είναι δημοσίως διαθέσιμα και παρέχουν έγκυρες ενδείξεις σχετικά με την πρόοδο μιας επιχείρησης.
- Διεξαγωγή Θεμελιώδης Ανάλυσης η οποία βοηθά τους επενδυτές να παρακολουθούν τις νέες εξελίξεις που επηρεάζουν μια εταιρία εξετάζοντας σχετικούς πολιτικούς και χρηματοοικονομικούς παράγοντες. Τέτοιοι παράγοντες περιλαμβάνουν τα επιτόκια, τον πληθωρισμό, τον αποπληθωρισμό, τα ποσοστά αύξησης του ΑΕΠ, τις στατιστικές απασχόλησης, τα εμπορικά ισοζύγια, τα πολιτικά γεγονότα, τις στρατιωτικές συγκρούσεις και την ποσοτική χαλάρωση που πραγματοποιούν οι κεντρικές τράπεζες.
- Διεξαγωγή Τεχνικής Ανάλυσης βοηθά τους επενδυτές να εντοπίσουν τον καλύτερο χρόνο για να επενδύσουν σε μια εταιρία χρησιμοποιώντας μια σειρά αριθμοδεικτών που υποδεικνύουν πότε πρέπει να ανοίξουν ή να κλείσουν τις θέσεις τους. Θα πρέπει να συμβουλευτούν διαφορετικές κατηγορίες αριθμοδεικτών και η συναλλαγή θα πρέπει να εκτελείται μόνο όταν πολλές από αυτές σηματοδοτούν την ίδια ενέργεια.
- Συνετή χρήση εντολών Διακοπής Απώλειας (Stop-loss). Οι εντολές αυτές συμβάλλουν στον περιορισμό των ζημιών σε περίπτωση που οι τιμές υποχωρήσουν μετά την πραγματοποίηση μιας επένδυσης. Για παράδειγμα, ο καθορισμός εντολής διακοπής απώλειας στο 5% κάτω από την τιμή αγοράς θα περιορίσει την απώλεια στο 5%. Ωστόσο, οι τιμές ενδέχεται τελικά να ανεβούν μετά από μια αρχική απόσυρση, οπότε τέτοιες τοποθετήσεις πρέπει να γίνονται με προσοχή.
- Διασφάλιση ότι τα χρήματα που δεσμεύονται για την επένδυση δεν θα χρειαστούν στο άμεσο μέλλον, ούτε σε περίπτωση έκτακτης ανάγκης. Αυτό θα σταματήσει τον επενδυτή από το να πανικοβληθεί και θα τον βοηθήσει να είναι αντικειμενικός και συγκεντρωμένος στις αποφάσεις του.

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1. Introduction

The Nasdaq-100 is a stock market index which consists of 103 equity securities issued by 100 of the largest publicly-traded companies in the United States that are listed on the Nasdaq stock market, excluding the financial sector. It features some of the biggest companies in the world including the only four in the U.S. to have surpassed the trillion-dollar mark. As an index, the value of the Nasdaq-100 is not dependent on a single company and that makes it a low-risk investment. The Nasdaq-100 is also a well-diversified investment since the companies listed on it, do not all belong in the same sector. These facts make investing in the Nasdaq-100 an interesting and appealing option.

In order to evaluate the Nasdaq-100 as an investment option, the companies it consists of needed to be examined. A sub-total of the twenty biggest companies of this index were chosen to be financially analyzed from 2016 to 2019. These companies constitute 71.035% of the capital contained in this index and thus their performance as an average should mirror the performance of the Nasdaq-100. During this analysis, the financial indicators for solvency, performance and performance-management were calculated. These indicators were calculated using public financial documents such as balance sheets and income statements of each company. Based on the value of these financial indicators, the health and progress of each company could be assessed, ultimately leading to conclusions about the Nasdaq-100 as a whole.

In order to optimize the timing of their transactions and secure maximum profits, investors can use technical analysis indicators that inform them when they should open or close their positions. These indicators are mathematical calculations that aim to predict the future price movement of an asset by analyzing the past performance of its price or volume. Technical indicators can either be momentum oscillators, trend indicators, volume indicators or volatility indicators. An experienced investor will use indicators of different categories in correlation to one another in order to achieve the best results. However, in this thesis, technical indicators were assessed individually.

In order to provide a list of the most reliable technical indicators for the Nasdaq-100, a selection of the most commonly used and trusted indicators was calculated using daily price data of the Nasdaq-100 from 2016 to 2019. The indicator categories chosen to be included in this analysis were momentum oscillators and trend indicators. Volume and volatility indicators were not included since they do not provide clear BUY and SELL signals to evaluate. Trend Indicators only show BUY and SELL signals while momentum oscillators show OVERBOUGHT, BUY, SELL and OVERSOLD signals. In order for the daily signals of the indicators to be assessed correctly, their performance was observed in daily, weekly and monthly periods. Also, two different scenarios were examined; one with 0% commission per transaction and one with 1.5% (commissions are usually between 1-2%). The results show the combinations of indicators and time periods that produce the best investment returns for each one of the two scenarios.

This thesis aims to evaluate the Nasdaq-100 as an investment option and to provide the most reliable technical indicators for a successful investment in this index, by answering the following questions:

- Does the Nasdaq-100 feature healthy companies with growth potential and innovative character?
- Which are the most accurate technical analysis indicators to consider when investing in the Nasdaq-100 index commission-free?
- Which are the most accurate technical analysis indicators to consider when investing in the Nasdaq-100 index with an average commission?

2. The Nasdaq-100

2.1 History

Nasdaq is an acronym that stands for the National Association of Securities Dealers Quotation. It is a global electronic marketplace in which traders can either buy or sell securities. Nasdaq was designed by the National Association of Securities Dealers (NASD) to enable investors to perform high speed trades in a computerized system. It was also used to exchange securities of companies that were not offered on a formal exchange, most of which were technology companies. Nasdaq begun operations on February 8, 1971 as the first ever electronic stock market, located at One Liberty Plaza in New York City. Second only to the New York Stock Exchange (NYSE), it is the stock exchange with highest number of shares traded by market capitalization. Unlike the NYSE however, Nasdaq does not have a trading floor since all the buying and selling of securities takes place electronically. Nasdaq officially separated from the NASD in 2006 and began to function as a national securities exchange. In 2007, it merged with the Scandinavian exchange group OMX and formed the Nasdaq OMX group in New York. Since then, the Nasdaq OMX group has been the largest exchange company in the world which operates 25 markets, a clearinghouse and five central securities depositories in Europe and the United States. The Nasdaq OMX group is listed on the Nasdaq stock exchange as NDAQ. The term Nasdaq is often used to refer to the Nasdaq 3,000, which is an index that features 3,000 stocks that are listed on the Nasdaq stock exchange.

The Nasdaq-100 is a stock market index which consists of 103 equity securities issued by 100 of the largest publicly-traded companies in the United States that are listed on the Nasdaq stock market, excluding the financial sector. These non-financial sectors include technology, biotechnology, industrial, technology, health care, retail, consumer services and consumer goods. Since its creation in 1985, the Nasdaq-100 (also referred to as US Tech 100), has been defined by a modified weighted market capitalization system. This particular index can be traded through the Invesco QQQ trust.

2.2 Index Value

As is the case with all indices, the price of Nasdaq-100 is determined by the performance of the stocks that the index is comprised of, as well as external fundamental factors.

Earnings reports, press releases and new product announcements can have a major impact on a company's stock price and performance. Since the Nasdaq-100 has been defined by a weighted market capitalization system, the stock price fluctuations of larger companies are more likely to impact the price of the index.

Fundamental Factors, especially in the United States, such as political events, interest rates, inflation and unemployment reports can also affect the value of the index directly or indirectly by affecting the stock prices of companies that are listed on it. These events can also shift consumer spending habits and change the investment strategies of companies.

2.3 Listed Companies

Although 100 companies are listed on the Nasdaq-100, the index features 103 symbols due to several companies with two share classes.

The companies listed on the Nasdaq-100 are being reviewed quarterly and are added or removed based on their market capitalization value. For a company to be listed on the Nasdaq 100, the following criteria must be met:

- It must either be listed on the Nasdaq Global Select Market or Nasdaq Global Market
- It must submit annual and quarterly reports
- It must be publicly offered for a minimum period of three months
- It must not be engaged with bankruptcy proceedings
- It must have an average daily volume of 200,000 shares

The Nasdaq-100 consists of 103 equity securities issued by 100 of the largest publicly-traded companies in the United States that are listed on the Nasdaq stock market, excluding the financial sector. A large percentage of the index features companies in the technology sector, which sum up to 54% of the index's weight. Consumer services is the next largest sector followed by healthcare, industrials and telecommunications. This variety of sectors is part of what makes an investment in Nasdaq-100 a well-diversified investment with strong returns.

The companies listed on the Nasdaq-100, as stated previously, are subject to change every quarter. For this thesis, the components of Nasdaq-100 that will be analyzed are the ones it featured on March 20, 2020. These components are presented in the following table along with their symbols, weights and closing stock prices on the current date.

	Components of the Nasdaq 100 *Data as of 20/03/2020*			
#	**Company**	**Symbol**	**Weight**	**Price**
1	Microsoft Corp	MSFT	11.630%	136.41
2	Apple Inc	AAPL	11.305%	228
3	Amazon.com Inc	AMZN	10.159%	1,829.10
4	Alphabet Inc	GOOG	4.089%	1,067.38
5	Alphabet Inc	GOOGL	4.076%	1,060.00
6	Facebook Inc	FB	3.999%	148
7	Intel Corp	INTC	2.823%	45.64
8	Comcast Corp	CMCSA	2.145%	33.31
9	Cisco Systems Inc	CSCO	2.138%	35.59
10	Netflix Inc	NFLX	2.065%	330
11	PepsiCo Inc	PEP	2.052%	104.5
12	Adobe Inc	ADBE	2.024%	294
13	Costco Wholesale Corp	COST	1.817%	288.5
14	NVIDIA Corp	NVDA	1.783%	203.2
15	Amgen Inc	AMGN	1.584%	185.6
16	PayPal Holdings Inc	PYPL	1.441%	86
17	Gilead Sciences Inc	GILD	1.312%	73.8
18	Texas Instruments Inc	TXN	1.292%	97.45
19	Charter Communications Inc	CHTR	1.130%	371.68
20	Tesla Inc	TSLA	1.091%	423.78

21	Broadcom Inc	AVGO	1.080%	191
22	QUALCOMM Inc	QCOM	0.985%	60.35
23	Starbucks Corp	SBUX	0.970%	57.99
24	T-Mobile US Inc	TMUS	0.903%	74.54
25	Mondelez International Inc	MDLZ	0.883%	43.3
26	Fiserv Inc	FISV	0.787%	80.7
27	Vertex Pharmaceuticals Inc	VRTX	0.750%	205
28	Intuit Inc	INTU	0.744%	202
29	Biogen Inc	BIIB	0.712%	278.9
30	Booking Holdings Inc	BKNG	0.697%	1,170.00
31	Automatic Data Processing Inc	ADP	0.687%	111
32	Regeneron Pharmaceuticals Inc	REGN	0.670%	445
33	Intuitive Surgical Inc	ISRG	0.645%	390
34	Advanced Micro Devices Inc	AMD	0.625%	39.41
35	Walgreens Boots Alliance Inc	WBA	0.587%	46.39
36	Activision Blizzard Inc	ATVI	0.566%	51.5
37	Micron Technology Inc	MU	0.566%	35.85
38	CSX Corp	CSX	0.552%	49.6
39	Illumina Inc	ILMN	0.504%	239
40	Applied Materials Inc	AMAT	0.497%	37.78
41	JD.com Inc ADR	JD	0.494%	37.36
42	Autodesk Inc	ADSK	0.460%	146.57
43	Analog Devices Inc	ADI	0.444%	83.45
44	Exelon Corp	EXC	0.427%	31.18
45	Monster Beverage Corp	MNST	0.397%	51.05
46	Lam Research Corp	LRCX	0.386%	185
47	Kraft Heinz Co/The	KHC	0.385%	22.3
48	Xcel Energy Inc	XEL	0.384%	50
49	Electronic Arts Inc	EA	0.359%	86
50	Baidu Inc ADR	BIDU	0.347%	87.07
51	Marriott International Inc/MD	MAR	0.345%	75.1
52	Cognizant Technology Solutions Corp	CTSH	0.342%	44.09
53	Ross Stores Inc	ROST	0.327%	62.52
54	MercadoLibre Inc	MELI	0.319%	450
55	eBay Inc	EBAY	0.318%	27.52
56	NetEase Inc ADR	NTES	0.294%	284.99
57	NXP Semiconductors NV	NXPI	0.291%	73.52
58	Workday Inc	WDAY	0.290%	124.75
59	Lululemon Athletica Inc	LULU	0.288%	164.49
60	Verisk Analytics Inc	VRSK	0.288%	124.25
61	CoStar Group Inc	CSGP	0.286%	550
62	O'Reilly Automotive Inc	ORLY	0.283%	263.42
63	Willis Towers Watson PLC	WLTW	0.278%	152.63
64	Sirius XM Holdings Inc	SIRI	0.278%	4.42
65	Paychex Inc	PAYX	0.263%	52.01
66	VeriSign Inc	VRSN	0.261%	157.13
67	Cintas Corp	CTAS	0.257%	170
68	Xilinx Inc	XLNX	0.256%	71.82
69	PACCAR Inc	PCAR	0.256%	52.29
70	Dollar Tree Inc	DLTR	0.255%	75.85
71	KLA Corp	KLAC	0.255%	113
72	ANSYS Inc	ANSS	0.254%	213.11
73	Alexion Pharmaceuticals Inc	ALXN	0.252%	80.35
74	Cerner Corp	CERN	0.251%	56.37
75	Seattle Genetics Inc	SGEN	0.242%	99.25

76	Splunk Inc	SPLK	0.236%	109.4
77	Synopsys Inc	SNPS	0.234%	110
78	Fastenal Co	FAST	0.233%	28.71
79	ASML Holding NV	ASML	0.227%	214
80	IDEXX Laboratories Inc	IDXX	0.223%	183.5
81	Citrix Systems Inc	CTXS	0.220%	119.03
82	Cadence Design Systems Inc	CDNS	0.219%	55
83	Incyte Corp	INCY	0.204%	64.51
84	Microchip Technology Inc	MCHP	0.202%	59.25
85	Copart Inc	CPRT	0.198%	60.11
86	Check Point Software Technologies Ltd	CHKP	0.193%	88.53
87	BioMarin Pharmaceutical Inc	BMRN	0.186%	73.22
88	Skyworks Solutions Inc	SWKS	0.178%	73.3
89	Trip.com Group Ltd ADR	TCOM	0.169%	22.77
90	Maxim Integrated Products Inc	MXIM	0.169%	44.12
91	Align Technology Inc	ALGN	0.162%	144.1
92	CDW Corp/DE	CDW	0.162%	79.51
93	Take-Two Interactive Software Inc	TTWO	0.161%	100.13
94	Western Digital Corp	WDC	0.131%	30.95
95	Ulta Beauty Inc	ULTA	0.123%	146
96	NetApp Inc	NTAP	0.117%	36.21
97	Fox Corp	FOXA	0.105%	21.1
98	Liberty Global PLC	LBTYK	0.103%	15.52
99	Expedia Group Inc	EXPE	0.096%	48.64
100	United Airlines Holdings Inc	UAL	0.088%	24.35
101	Fox Corp	FOX	0.076%	20.05
102	American Airlines Group Inc	AAL	0.064%	10.46
103	Liberty Global PLC	LBTYA	0.045%	16.61

Table 1: Nasdaq-100 Components as of 20/03/2020

3. Financial Indicators

Most characteristics of a company's financial situation such as financial balance, debt and growth can be quantified with the help of financial indicators (Niarchos, 2004). The values of these financial indicators derive from information contained in the financial statements of the examined company such as income statements and balance sheets. Financial indicators are calculated mathematically in the form of a fraction consisting of financial data that can be correlated effectively. The fraction counter expresses the object of comparison while the denominator expresses the basis of comparison.

For a financial analysis to be successful the selected group of indicators must dynamically describe all the financial activities of the company and measure its profitability. The most important categories of indicators that should be included in a financial analysis according to Courtis (1978) and Zopounidis (2013) are the following:

- Solvency Indicators
- Profitability Indicators
- Management Performance Indicators

3.1 Solvency Indicators

Solvency is the ability of an enterprise to meet its debts and financial obligations both on long and short terms. It is the main indication of a company's ability to manage its operations in the near future and thus it is an important measure of financial health.

I.   Total Debt Capacity Indicator

This indicator shows the percentage of the total assets that a financial institution uses in order to cover its long-term and short-term liabilities. Small values of this indicator are preferable and point to the company not being encumbered with loans and other liabilities to third parties.

According to international norms for this indicator, values less than 66.7% are satisfactory, between 66.7% and 80% are moderate and higher than 80% point to over-indebtedness.

$$Total\ Debt\ Capacity = \frac{Total\ Liabilities}{Total\ Assets}$$

II.   Long Term Debt Capacity Indicator

This indicator shows the percentage of business capital (stockholder's equity plus long-term liabilities) that is covered by stockholder's equity. Higher values of this indicator are preferable and a value of 100% means that the company is free from long-term liabilities.

According to international norms for this indicator, values higher than 50% are satisfactory.

$$Long\ Term\ Debt\ Capacity = \frac{Stockholder's\ Equity}{Stockholder's\ Equity + Long\ Term\ Liabilities}$$

III.   Current Ratio

This indicator shows how many times a company would be able to pay its current liabilities, if it converts its short-term receivables and financial assets to cash. The more predictable a company's cash inflows, the more generally acceptable a lower value is, although this is mainly a dependable on the industry to which the company belongs.

According to international norms for this indicator, values higher than 2 are satisfactory.

$$Current\ Ratio = \frac{Current\ Assets}{Current\ Liabilities}$$

IV.   Quick Ratio

This indicator examines whether the current liabilities of a company are able to be met by its financial assets. Higher values of this indicator suggest greater financial health.

According to international norms for this indicator, values higher than 1 are satisfactory.

$$Quick\ Ratio = \frac{Current\ Assets - Inventory}{Current\ Liabilities}$$

V.   Working Capital Indicator

This indicator shows the percentage of total current assets that come from fixed funds (total stockholder's equity plus total non-current liabilities). Higher values of this indicator are preferable.

According to international norms for this indicator, values higher than 1 are satisfactory.

$$Working\ Capital\ Indicator = \frac{Stockholder's\ Equity + Long\ Term\ Liabilities}{Current\ Assets}$$

VI.   Interest Coverage Indicator

This indicator shows the relationship between the net profit of a company and the interest with which it is charged when using foreign capital. It shows a company's ability to repay the interest of foreign capital from its profits, becoming a measure of its profitability. The higher the index price, the more profitable the business.

According to international norms for this indicator, values higher than 3 are satisfactory, between 1 and 2 are moderate and less than 1 are unsatisfactory.

$$Interest\ Coverage = \frac{Operating\ Income\ or\ Loss}{Interest\ Expense}$$

VII.   Financial Leverage Indicator

This indicator shows what effect the use of loaned funds has on the returns of a company. Depending on whether the price of the index is greater, equal to or less than 1, the use of foreign capital on the company's profits is respectively positive, zero or negative.

According to international norms for this indicator, only values higher than 1 are satisfactory.

$$Financial\ Leverage = \frac{Total\ Assets}{Stockholder's Equity}$$

3.2 Profitability Indicators

A company's ability to produce positive or negative results is defined as its performance. Performance indicators are used to calculate a company's ability to make a profit, which makes the company more appealing to potential investors.

I.   Net Profit Margin

This indicator illustrates how much of each dollar in revenue collected by a company translates into profit. Higher index values are preferable since they indicate a the more profitable business.

According to international norms for this indicator, values higher than 20% are satisfactory, less than 5% are unsatisfactory and in between are average. However, these variables vary widely by industry and company size.

$$Net\ Profit\ Margin = \frac{Net\ Income}{Total\ Revenue}$$

II.   Financial Profitability

This indicator provides an insight of whether the goal of achieving a satisfactory result from the use of shareholder funds has been achieved. Higher index values indicate a higher profitability and as such, are preferable.

According to international norms for this indicator, values higher than 0% are satisfactory.

$$Financial\ Profitability = \frac{Net\ Income}{Stockholder's Equity}$$

III.   Return on Assets

This indicator measures the return of a company's total assets and allows the effectiveness of its operation to be evaluated. Higher index values indicate the company's ability to generate high profits in comparison to its assets.

According to international norms for this indicator, values higher than 0% are satisfactory.

$$Return\ On\ Assets = \frac{Net\ Income}{Total\ Assets}$$

IV.   Gross Profit Indicator

This indicator shows the operational efficiency of a company and evaluates its pricing policy. A high index value demonstrates the ability of a company's management to achieve cheap purchases and sell at high prices.

According to international norms for this indicator, values higher than 0 are satisfactory.

$$Gross\ Profit\ Indicator = \frac{Gross\ Profit}{Total\ Revenue}$$

V.   Assets Turnover Indicator

This indicator shows if there is an overinvestment of capital in a company in relation its revenue. However, the elements of this index are greatly influenced by industry the company belongs to and the method of depreciation that it follows. In general, the higher the index value, the more efficiently the company's assets have been used.

According to international norms for this indicator, values higher than 1 are satisfactory.

$$Assets\ Turnover\ Indicator = \frac{Total\ Revenue}{Total\ Assets}$$

3.3 Management Performance Indicators

These indicators show the effectiveness with which a company uses its assets and they evaluate its credit policy by assessing the asset and liability structures as well as the management of the company's expenses.

I.   Financial Expense Significance Indicator

This indicator compares the revenue of a company with its total financial expenses. Ideally, revenue should exceed financial costs and thus lower prices of this index are preferable.

According to international norms for this indicator, values lower than 5% are satisfactory.

$$Financial\ Expense\ Significance = \frac{Interest\ Expense}{Total\ Revenue}$$

II.   General & Administrative Expense Importance Indicator

Much like the previous indicator, this index compares the revenue of a company with its general and administrative expenses. Ideally, revenue should exceed these types of expenses and thus lower prices of this index are preferable.

According to international norms for this indicator, values lower than 5% are satisfactory.

$$General\ \&\ Administrative\ Expense\ Significance = \frac{General\ and\ Administrative\ Expenses}{Total\ Revenue}$$

4. Financial Analysis of Nasdaq-100 and Components

In order for the Nasdaq-100 to be considered a safe and profitable investment, the companies it comprises of must prove financially capable. In this chapter, the twenty largest companies listed on the Nasdaq-100 as of March 20, 2020 were chosen to be financially analyzed from 2016 to 2019. During this analysis, the financial indicators for solvency, performance and performance-management were calculated using public financial documents including balance sheets and income statements of each company. Based on these indicators, the financial status and progress of each company could be effectively evaluated.

4.1 Microsoft Corp.

Microsoft (NASDAQ: MSFT) is one of the biggest tech companies in the world. Based on Redmond, Washington, it engages in the development and support of devices, services, software, and solutions. The company was founded in 1975 by Bill Gates and Paul Allen in a garage in New Mexico. Its first major project was providing the operating system for IBM's first personal computer in 1980. Microsoft launched its now omnipresent Windows software product in 1985 and by the end of the 1980s it became the largest personal-computer software company in the world. Since then, Microsoft's stock price has risen more than a hundred-fold, making it one of the biggest companies by market capitalization value.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Microsoft from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Microsoft Corp Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.6428	0.6804	0.6997	0.6282
Long Term Debt Capacity Indicator	0.4712	0.4128	0.4100	0.5359
Current Ratio	2.5288	2.9008	2.4772	2.3528
Quick Ratio	2.4991	2.8552	2.4434	2.3149
Working Capital Indicator	1.2368	1.1809	1.1045	0.9618
Interest Coverage Indicator	15.99	12.82	10.18	17.12
Financial Leverage Indicator	2.8003	3.1292	3.3301	2.6903
Profitability Indicators				
Net Profit Margin	0.3118	0.1501	0.2357	0.1968
Financial Profitability	0.3834	0.2003	0.2928	0.2333
Return on Assets	0.1369	0.0640	0.0879	0.0867
Gross Profit Indicator	0.6590	0.6524	0.6191	0.6157
Assets Turnover Indicator	0.4391	0.4263	0.3731	0.4404
Management Performance Indicators				

Financial Expense Significance Indicator	0.0213	0.0247	0.0247	0.0145
Importance of General and Administrative Expenses indicator	0.1835	0.2013	0.2225	0.2257

Table 2: MSFT Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has good values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows a great first year followed by substandard values from 2017 to 2019, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. However, a positive progression can be observed during the final three years with a final value of 47.127% being close to the 50% which is considered great.

The Current Ratio takes great values throughout the examined time period, meaning that this company could pay twice its current liabilities in case of liquidation.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows a substandard first year. However, a positive progression with great values can be observed from 2017 to 2019, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has good values throughout the examined time period and a positive progression from 2016 to 2019, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. Furthermore, there is a negative progression from 2016 to 2019. However, Microsoft is of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets.

<u>Management Performance Indicators</u>

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, despite the positive progression from 2016 to 2019 and the final value of 18.354%, these expenses are over three times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Microsoft could be responsible for such deviation.

4.2 Apple Inc.

Apple Inc. (NASDAQ: AAPL) is a global technology company headquartered in Cupertino, California. It engages in designing, manufacturing, and selling smartphones, tablets, personal computers and accessories. Some of its most widespread products include the iPhone, iMac, iPad, Apple Watch and Apple TV. The company also offers iCloud cloud services and digital streaming-content services like Apple TV+ and Apple Music.

Since its founding in 1976, the tech giant has transformed into a diversified technology behemoth that is officially the biggest company in the world by market value. When it comes to acquiring new companies, Apple's strategy has been to obtain small tech companies that it can easily incorporate into its expanding line of products.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Apple from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Apple Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.7326	0.7070	0.6428	0.6013
Long Term Debt Capacity Indicator	0.3886	0.4305	0.4883	0.5284
Current Ratio	1.5401	1.1238	1.2760	1.3526
Quick Ratio	1.5012	1.0899	1.2279	1.3256
Working Capital Indicator	1.4297	1.8947	2.1338	2.2708
Interest Coverage Indicator	17.87	21.88	26.40	41.22
Financial Leverage Indicator	3.7410	3.4133	2.7999	2.5082
Profitability Indicators				
Net Profit Margin	0.2123	0.2241	0.2109	0.2118
Financial Profitability	0.6106	0.5556	0.3607	0.3562
Return on Assets	0.1632	0.1627	0.1288	0.1420

Gross Profit Indicator	0.3781	0.3834	0.3846	0.3907
Assets Turnover Indicator	0.7685	0.7262	0.6107	0.6703
Management Performance Indicators				
Financial Expense Significance Indicator	0.0137	0.0121	0.0101	0.0067
Importance of General and Administrative Expenses indicator	0.0701	0.0628	0.0665	0.0658

Table 3: AAPL Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has good values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties. Nevertheless, a negative progression can be observed that results in moderate values for the final two years.

The Long Term Debt Capacity Indicator shows a great first year followed by substandard values from 2017 to 2019, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Furthermore, a negative progression can be observed during the final three years.

The Current Ratio takes substandard values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. However, there is a positive progression from 2016 to 2019 with a final value of 1.54012 which indicates the company's ability to pay off its liabilities with a 54.012% remainder of its market value.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has great values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Apple is of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019 with a final value of 76.857% which is significantly higher than the 61.077% value of 2017.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. However, despite the negative progression from 2016 to 2019, the final value of 7.012% is relatively close to the 5% indicated by international norms as the maximum. Furthermore, the technological nature and immense market capitalization value of Apple could be responsible for such deviation.

4.3 Amazon.com Inc.

Amazon.com Inc. (NASDAQ: AMZN) is one of the largest companies in the world by market value. It engages in e-commerce and cloud computing services. The company founded by Jeff Bezos in 1994 exclusively as an online bookstore. Since then, it has grown into the world's largest e-commerce company, selling virtually anything, including electronics, furniture, apparel, toys, and more.

In addition to e-commerce, Amazon's revenue is fueled by cloud computing and subscription services, Whole Foods grocery sales, and other areas. It also develops and sells its own consumer electronics like Amazon Echo and Kindle. The world's largest seller of cloud computing services is Amazons Web Services. The company also offers entertainment-streaming services, providing access to movies, TV shows and music.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Amazon from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Amazon.com Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.7244	0.7322	0.7889	0.7687
Long Term Debt Capacity Indicator	0.4515	0.4620	0.3773	0.4871
Current Ratio	1.0970	1.0981	1.0399	1.0448

Quick Ratio	0.8814	0.9592	0.8591	0.8931
Working Capital Indicator	1.4266	1.2550	1.2197	0.8646
Interest Coverage Indicator	9.08	8.76	4.84	8.64
Financial Leverage Indicator	3.6295	3.7348	4.7388	4.3247
Profitability Indicators				
Net Profit Margin	0.0413	0.0432	0.0170	0.0174
Financial Profitability	0.1867	0.2313	0.1094	0.1229
Return on Assets	0.0514	0.0619	0.0230	0.0284
Gross Profit Indicator	0.2664	0.2563	0.2287	0.2213
Assets Turnover Indicator	1.2453	1.4318	1.3545	1.6305
Management Performance Indicators				
Financial Expense Significance Indicator	0.0057	0.0060	0.0047	0.0035
Importance of General and Administrative Expenses indicator	0.0858	0.0779	0.0772	0.0710

Table 4: AMZN Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has moderate values and a positive progression throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows substandard values throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Furthermore, a negative progression can be observed from 2016 to 2019.

The Current Ratio takes substandard values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. However, there is a positive progression from 2016 to 2019 with a final value of 1.09704 which indicates the company's ability to pay off its liabilities with a 9.704%% remainder of its market value.

The Quick Ratio has substandard values throughout the examined time period, meaning that liabilities of this company could not be met by its financial assets. Furthermore, a negative progression can be observed from 2016 to 2019.

The Working Capital Indicator shows a substandard first year followed by great values from 2017 to 2019 meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has substandard values throughout the examined time period, meaning that this company gets to keep a very low percentage of every dollar it makes. However, a positive progression can be observed from 2016 to 2019.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has great values throughout the examined time period, meaning that there isn't an overinvestment of capital in this company in relation to its revenue.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. However, despite the negative progression from 2016 to 2019, the final value of 8.584% is relatively close to the 5% indicated by international norms as the maximum. Furthermore, the immense market capitalization value of Amazon could be responsible for such deviation.

4.4 Alphabet Inc.

Alphabet Inc. (NASDAQ: GOOGL, Class A and GOOG, Class C) was founded in 1998 as a search engine company under the name Google Inc. Thenceforth, Google has become the world's most popular search engine, attaining an 87% share of the global search market. Google Inc. was reorganized in 2015 and the parent company which held Google and a number of other companies was named Alphabet Inc.

Since its introduction, the company has expanded beyond just search platforms. Alphabet's revenue comes from the Google Search engine, Chrome browser, YouTube, Google Play, Google Cloud and the Android operating system. Furthermore, the company has made sizeable investments in cloud gaming systems, self-driving vehicles, and other technology innovations.

Class-A shares or "common shares" give investors voting rights and an ownership stake in the company. Class-C shares give shareholders an ownership stake in the company, but unlike common shares, they do not offer any voting rights to stockholders. As a result, Class-C shares tend to trade at a lower price than Class-A shares.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Alphabet from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Alphabet Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Dept Capacity Indicator	0.2698	0.2369	0.2270	0.1699
Long Term Dept Capacity Indicator	0.8732	0.8963	0.8809	0.9223
Current Ratio	3.3740	3.9190	5.1403	6.2907
Quick Ratio	3.3519	3.8870	5.1093	6.2747
Working Capital Indicator	1.5119	1.4606	1.3926	1.4300
Interest Coverage Indicator	359.28	275.36	264.97	191.25
Financial Leverage Indicator	1.3696	1.3105	1.2937	1.2047
Profitability Indicators				
Net Profit Margin	0.2121	0.2246	0.1142	0.2157
Financial Profitability	0.1704	0.1730	0.0830	0.1400
Return on Assets	0.1244	0.1320	0.0641	0.1162
Gross Profit Indicator	0.5558	0.5647	0.5888	0.6107
Assets Turnover Indicator	0.5866	0.5877	0.5618	0.5389
Management Performance Indicators				
Financial Expense Significance Indicator	0.0006	0.0008	0.0009	0.0013
Importance of General and Administrative Expenses indicator	0.1730	0.1787	0.1782	0.1935

Table 5: GOOGL Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows great values throughout the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes great values throughout the examined time period, meaning that this company could easily pay twice its current liabilities in case of liquidation.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

The Net Profit Margin has good values throughout the examined time period, meaning that this

company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Alphabet is of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, despite the positive progression from 2016 to 2019, the final value of 17.308% is over three times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Alphabet could be responsible for such deviation.

4.5 Facebook Inc.

Facebook Inc. (NASDAQ: FB) was founded by Mark Zuckerberg and his Harvard roommates in 2004 under the name FaceMash. Later that name was changed to TheFacebook and finally, Facebook. Zuckerberg and his co-founders initially launched the service for their Harvard classmates, but when they realized its potential, they wasted no time in quickly expanding it to other universities and to the general public. The company has since grown into a global giant and is currently recognized as the world's largest social networking website. Facebook has expanded far beyond its original social networking platform by engaging in messenger services, photo and video sharing, augmented reality, and many other applications and services. Acquisitions have been crucial to growing these businesses and the company's revenue in general.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Facebook from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Facebook Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.2423	0.1356	0.1204	0.0887
Long Term Debt Capacity Indicator	0.8540	0.9314	0.9205	0.9534
Current Ratio	4.3994	7.1939	12.9156	11.9655
Quick Ratio	4.3994	7.1939	12.9156	11.9655
Working Capital Indicator	1.7866	1.7891	1.6630	1.8047
Interest Coverage Indicator	1199.30	2768.11	3367.16	1242.70
Financial Leverage Indicator	1.3198	1.1569	1.1368	1.0974
Profitability Indicators				
Net Profit Margin	0.2614	0.3960	0.3919	0.3696
Financial Profitability	0.1829	0.2628	0.2143	0.1726
Return on Assets	0.1385	0.2271	0.1885	0.1572
Gross Profit Indicator	0.8193	0.8324	0.8658	0.8629
Assets Turnover Indicator	0.5300	0.5736	0.4809	0.4254
Management Performance Indicators				
Financial Expense Significance Indicator	0.0002	0.0001	0.0001	0.0003
Importance of General and Administrative Expenses indicator	0.2877	0.2023	0.1781	0.1991

Table 6: FB Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows great values throughout the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes great values throughout the examined time period, meaning that this company could easily pay twice its current liabilities in case of liquidation.

The Quick Ratio Indicator has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has great values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Facebook is of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019 with a final value of 53.005% which is significantly higher than the 42.545% value of 2017.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, there is a negative progression from 2016 to 2019, with the final value of 28.772% being over five times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Facebook could be responsible for such deviation.

4.6 Intel Corp.

Intel Corporation (NASDAQ: INTC) was founded by Robert Noyce and Gordon Moore in 1968. The company was initially named NM Electronics and after a few months the name was changed to Integrated Electronics Corporation. Intel engages in the development, manufacture, and sale of computer technologies and products. It offers computer, data storage, communication and networking platforms. Since its creation, the company has evolved into one of the biggest semiconductor companies in the world.

 The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Intel from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.4311	0.4140	0.4329	0.4078
Long Term Debt Capacity Indicator	0.6799	0.6734	0.6603	0.7213
Current Ratio	1.4002	1.7314	1.6933	1.7489
Quick Ratio	1.0082	1.2952	1.2925	1.4754
Working Capital Indicator	3.6561	3.8676	3.5873	2.6198
Interest Coverage Indicator	45.86	49.66	28.35	20.13
Financial Leverage Indicator	1.7579	1.7065	1.7635	1.6887
Profitability Indicators				
Net Profit Margin	0.2924	0.2971	0.1529	0.1737
Financial Profitability	0.2710	0.2807	0.1373	0.1537
Return on Assets	0.1541	0.1645	0.0778	0.0910
Gross Profit Indicator	0.5855	0.6173	0.6225	0.6094
Assets Turnover Indicator	0.5271	0.5536	0.5092	0.5240
Management Performance Indicators				
Financial Expense Significance Indicator	0.0067	0.0066	0.0102	0.0123
Importance of General and Administrative Expenses indicator	0.0854	0.0952	0.1190	0.1413

Table 7: INTC Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows great values throughout the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes substandard values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. Furthermore, there is a negative progression from 2016 to 2019 with a final value of 1.40022 which indicates the company's ability to pay off its liabilities with a 40.022% remainder of its market value.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has good values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes. Furthermore, a significant positive progression is observed from 2016 to 2019.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Intel is of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. However, there is a positive progression from 2016 to 2019 with the final value of 8.545% being relatively close to the 5% indicated by international norms as the maximum. Furthermore, the technological nature and immense market capitalization value of Intel could be responsible for such deviation.

4.7 Comcast Corp.

Comcast Corp. (NASDAQ: CMCSA) is a global media and technology conglomerate. The company was founded by Ralph Roberts in 1963 when he purchased American Cable Systems in Mississippi. The cable company was later incorporated under the name Comcast which is headquartered in Philadelphia, Pennsylvania. Comcast was first publicly traded in 1972 and has since grown into a world leader in media, entertainment, and technology.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Comcast from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.6815	0.7119	0.6285	0.6887
Long Term Debt Capacity Indicator	0.3566	0.3208	0.4169	0.3441
Current Ratio	0.8382	0.7915	0.7448	0.7597
Quick Ratio	0.8382	0.7915	0.7448	0.7597
Working Capital Indicator	9.1357	10.2156	10.2450	9.5797
Interest Coverage Indicator	4.62	5.36	5.82	5.73
Financial Leverage Indicator	3.1841	3.5145	2.7249	3.3461
Profitability Indicators				
Net Profit Margin	0.1198	0.1241	0.2687	0.1081
Financial Profitability	0.1578	0.1638	0.3310	0.1611
Return on Assets	0.0495	0.0466	0.1214	0.0481
Gross Profit Indicator	0.6838	0.6858	0.6996	0.6957
Assets Turnover Indicator	0.4135	0.3754	0.4521	0.4454
Management Performance Indicators				
Financial Expense Significance Indicator	0.0419	0.0374	0.0365	0.0365
Importance of General and Administrative Expenses indicator	0.3710	0.3717	0.3706	0.3671

Table 8: CMCSA Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has moderate values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties. Furthermore, a positive progression can be observed from 2016 to 2019.

The Long Term Debt Capacity Indicator shows substandard values during the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. However, a positive progression can be observed from 2016 to 2019.

The Current Ratio takes substandard values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. However, there is a positive progression from 2016 to 2019.

The Quick Ratio has substandard values throughout the examined time period, meaning that liabilities of this company can't be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

<u>Profitbility Indicators</u>

The Net Profit Margin has moderate values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes. Furthermore, a positive progression can be observed from 2016 to 2019.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Comcast is an extremely large company by market capitalization and thus it is understandable for its annual revenue to be overshadowed by its total assets.

<u>Management Performance Indicators</u>

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, a negative progression from 2016 to 2019 can be observed with the final value of 37.105% being over seven times higher than the maximum of 5% indicated by international norms. However, Comcast's nature and immense market capitalization value could be responsible for such deviation.

4.8 Cisco Systems Inc.

Cisco Systems (NASDAQ: CSCO) is a leading company in networking and information technology. The company engages in 5g wireless technologies, data centers, data security and artificial intelligence. Cisco was founded in 1984 and has since has acquired over 200 firms in order to make gains in market acceleration and expansion. The company is one of the largest in the networking and communications devices industry.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Cisco Systems from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.6567	0.6028	0.4905	0.4773
Long Term Debt Capacity Indicator	0.5080	0.5284	0.6469	0.6572
Current Ratio	1.5058	2.2872	3.0345	3.1600
Quick Ratio	1.4622	2.2190	2.9759	3.1111
Working Capital Indicator	1.3837	1.3220	1.2214	1.2289
Interest Coverage Indicator	16.92	13.43	14.78	19.12
Financial Leverage Indicator	2.9130	2.5179	1.9628	1.9131
Profitability Indicators				
Net Profit Margin	0.2238	0.0022	0.2001	0.2180
Financial Profitability	0.3461	0.0025	0.1452	0.1688
Return on Assets	0.1188	0.0010	0.0740	0.0882
Gross Profit Indicator	0.6293	0.6204	0.6296	0.6286
Assets Turnover Indicator	0.5307	0.4534	0.3697	0.4048
Management Performance Indicators				
Financial Expense Significance Indicator	0.0165	0.0191	0.0179	0.0137
Importance of General and Administrative Expenses indicator	0.2195	0.2308	0.2328	0.2321

Table 9: CSCO Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows great values during the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes great values from 2016 to 2018 with the exception of the final year, meaning that this company could pay twice its current liabilities in case of liquidation during the first three years. Furthermore, the final value of 1.50589, although substandard, indicates the company's ability to pay off its liabilities with a 50.589% remainder of its market value.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

The Net Profit Margin has mostly great values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes. However, an exception can be observed in 2018 with a substandard value. Although during that year the value of the examined indicator was extremely low, the overall progression from 2016 to 2019 is positive and the final value of 22.389% is considered great.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Cisco is an extremely large company by market capitalization and thus it is understandable for its annual revenue to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, despite the positive progression from 2016 to 2019, the final value of 21.959% is over four times over the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Cisco could be responsible for such deviation.

4.9 Netflix Inc.

Netflix Inc. (NASDAQ: NFLX) is one of the most recognized subscription streaming entertainment services in the world. The company allows its members to download or stream movies, TV series, feature films and documentaries. Headquartered in California, Netflix was launched in 1997 and at the time, it functioned as a mail-order movie and TV show delivery service.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Netflix from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.7768	0.7983	0.8116	0.8027
Long Term Debt Capacity Indicator	0.2795	0.2688	0.2644	0.2977
Current Ratio	0.9012	1.4943	1.4031	1.2471
Quick Ratio	0.9012	1.4943	1.4031	1.2471
Working Capital Indicator	4.3894	2.0101	1.7661	1.5733
Interest Coverage Indicator	4.15	3.81	3.52	2.53
Financial Leverage Indicator	4.4810	4.9581	5.3079	5.0700
Profitability Indicators				
Net Profit Margin	0.0926	0.0766	0.0478	0.0211
Financial Profitability	0.2462	0.2312	0.1560	0.0696
Return on Assets	0.0549	0.0466	0.0293	0.0137
Gross Profit Indicator	0.3828	0.3689	0.3449	0.3171
Assets Turnover Indicator	0.5932	0.6080	0.6149	0.6499
Management Performance Indicators				
Financial Expense Significance Indicator	0.0310	0.0266	0.0203	0.0169
Importance of General and Administrative Expenses indicator	0.1769	0.1899	0.1831	0.1776

Table 10: NFLX Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has substandard values during the first two years, meaning that this company is being encumbered with loans and other liabilities to third parties. Nevertheless, a positive progression can be observed that results in moderate values for the final two years.

The Long Term Debt Capacity Indicator shows substandard throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Furthermore, a negative progression can be observed from 2016 to 2019.

The Current Ratio takes substandard values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. Furthermore, there is a negative progression from 2016 to 2019.

The Quick Ratio has great values during the first three years, meaning that liabilities of this company can be met by its financial assets. However, the final value in 2019 is substandard and signals a negative progression from 2016 to 2019.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has good values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease. Furthermore, a positive progression can be observed from 2016 to 2019.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

<u>Profitability Indicators</u>

The Net Profit Margin has substandard values during the first two years followed by moderate values during the last two. This suggests that this company gets to keep a mediocre percentage of every dollar it makes. Furthermore, a significant positive progression can be observed from 2016 to 2019.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Netflix has grown to be one of the largest companies in its field by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets.

<u>Management Performance Indicators</u>

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, despite the positive progression from 2016 to 2019, the final value of 17.695% is over three times over the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Netflix could be responsible for such deviation.

4.10 PepsiCo Inc.

Headquartered in New York, PepsiCo Inc. (NASDAQ: PEP) is one of the world's largest food and beverage companies. The company was founded by Donald M. Kendall, Sr. and Herman W. Lay in 1965 and has since developed a diverse portfolio of recognizable and successful brands. Such brands include Quaker, Tropicana, Gatorade, Mountain Dew, Pepsi-Cola, Fritos, Lays, Cheetos, Doritos and Ruffles.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating PepsiCo from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

PepsiCo Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.8107	0.8119	0.8624	0.8489
Long Term Debt Capacity Indicator	0.2549	0.2619	0.1839	0.2097
Current Ratio	0.8623	0.9889	1.5133	1.2817
Quick Ratio	0.6992	0.8476	1.3696	1.1528
Working Capital Indicator	3.2872	2.5316	1.9083	1.9524
Interest Coverage Indicator	9.06	6.62	9.13	7.34
Financial Leverage Indicator	5.3122	5.3483	7.3288	6.6812
Profitability Indicators				
Net Profit Margin	0.1089	0.1935	0.0764	0.1007
Financial Profitability	0.4946	0.8620	0.4460	0.5704
Return on Assets	0.0931	0.1611	0.0608	0.0853
Gross Profit Indicator	0.5513	0.5456	0.5468	0.5508
Assets Turnover Indicator	0.8550	0.8327	0.7960	0.8471
Management Performance Indicators				
Financial Expense Significance Indicator	0.0168	0.0235	0.0181	0.0213
Importance of General and Administrative Expenses indicator	0.3981	0.3892	0.3814	0.3938

Table 11: PEP Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has substandard values throughout the examined time period, meaning that this company is being encumbered with loans and other liabilities to third parties. Furthermore, a negative progression can be observed from 2016 to 2019.

The Long Term Debt Capacity Indicator shows substandard values throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. However, a positive progression can be observed during the final three years.

The Current Ratio takes substandard values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. Furthermore, there is a negative progression from 2016 to 2019.

The Quick Ratio has great values during the first two years followed by substandard values during the last two years. The negative progression concludes that the liabilities of this company can't be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has moderate values throughout the examined time period, meaning that this company gets to keep a decent percentage of every dollar it makes. Furthermore, there is a positive progression from 2016 to 2019.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, PepsiCo is of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, there is a negative progression from 2016 to 2019 with the final value of 39.811% being over seven times higher than the maximum of 5% indicated by international norms. However, PepsiCo's immense market capitalization could be responsible for such deviation.

4.11 Adobe Inc.

Adobe Inc. (NASDAQ: ADBE) was founded in 1982 by John Warnock and Charles Geschke. Headquartered in San Jose, California, the company engages in the provision of digital marketing and media solutions. Adobe is recognized for its multimedia and creativity software products, such as Acrobat Reader, Adobe Photoshop, Adobe Acrobat, Adobe Illustrator and Adobe Creative Cloud.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Adobe from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Adobe Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Dept Capacity Indicator	0.4928	0.5011	0.4179	0.4156
Long Term Debt Capacity Indicator	0.8376	0.6471	0.7685	0.7503
Current Ratio	0.7929	1.1292	2.0546	2.0770
Quick Ratio	0.7929	1.1292	2.0546	2.0770
Working Capital Indicator	1.9355	2.9786	1.5188	1.6944
Interest Coverage Indicator	20.78	31.82	29.14	21.18
Financial Leverage Indicator	1.9717	2.0047	1.7181	1.7114
Profitability Indicators				
Net Profit Margin	0.2642	0.2869	0.2320	0.1996
Financial Profitability	0.2802	0.2767	0.2002	0.1574
Return on Assets	0.1421	0.1380	0.1165	0.0919
Gross Profit Indicator	0.8502	0.8676	0.8616	0.8599
Assets Turnover Indicator	0.5380	0.4811	0.5023	0.4607
Management Performance Indicators				
Financial Expense Significance Indicator	0.0140	0.0098	0.0101	0.0120
Importance of General and Administrative Expenses indicator	0.3692	0.3727	0.3865	0.4249

Table 12: ADBE Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows great values throughout the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes great values from 2016 to 2017 and substandard values from 2018 to 2019. The steep negative progression signals that this company could not pay twice its current liabilities in case of liquidation.

The Quick Ratio has great values during the first three years, meaning that liabilities of this company can be met by its financial assets. However, a negative progression can be observed resulting in a substandard 2019 value.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has good values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Adobe is of the largest companies in its field by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, despite the positive progression from 2016 to 2019, the final value of 36.924% is over seven times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Adobe could be responsible for such deviation.

4.12 Costco Wholesale Corp.

Costco Wholesale Corp. (NASDAQ: COST) was founded by Jim Sinegal and Jeff Brotman in 1983. The company engages in warehouse retailing in the U.S., Asia, Europe and Latin America. Costco's strategy is offering low prices on large packages of name-brand products. The company sells appliances, electronics, apparel and groceries at a lower price by limiting their selection of these

products. Although Costco is one of the biggest warehouse retailers in the world, it holds an average 3,700 active stock keeping units per warehouse, far less than many competitors.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Costco Wholesale from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Costco Wholesale Corp Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.6567	0.6790	0.6951	0.6281
Long Term Debt Capacity Indicator	0.6985	0.6213	0.5809	0.6967
Current Ratio	1.0106	1.0182	0.9898	0.9770
Quick Ratio	0.5202	0.4641	0.4277	0.4012
Working Capital Indicator	0.9291	1.0153	1.0712	1.1391
Interest Coverage Indicator	31.58	28.17	30.67	27.60
Financial Leverage Indicator	2.9784	3.1900	3.3723	2.7455
Profitability Indicators				
Net Profit Margin	0.0239	0.0221	0.0207	0.0197
Financial Profitability	0.2400	0.2448	0.2485	0.1945
Return on Assets	0.0805	0.0767	0.0737	0.0708
Gross Profit Indicator	0.1297	0.1301	0.1328	0.1332
Assets Turnover Indicator	3.3635	3.4674	3.5498	3.5798
Management Performance Indicators				
Financial Expense Significance Indicator	0.0009	0.0011	0.0010	0.0011
Importance of General and Administrative Expenses indicator	0.0981	0.0980	0.1003	0.1016

Table 13: COST Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has good values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties. Furthermore, a positive progression can be observed from 2016 to 2019.

The Long Term Debt Capacity Indicator shows great values throughout the examined period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes substandard values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. However, there is a positive progression from 2016 to 2019 with a final value of 1.01067 which indicates the company's ability to pay off its liabilities with a slight remainder of its market value.

The Quick Ratio has substandard values throughout the examined time period, meaning that liabilities of this company can't be met by its financial assets. However, a positive progression can be observed from 2016 to 2019.

The Working Capital Indicator shows great values during the first three years, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities). However, in 2019 the is a substandard value of the indicator signaling a negative progression.

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has substandard values throughout the examined time period, meaning that this company gets to keep a low percentage of every dollar it makes. However, there is a positive progression from 2016 to 2019.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets Indicator has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has great values throughout the examined time period, meaning that there isn't an overinvestment of capital in this company in relation to its revenue.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. However, in addition to the positive progression from 2016 to 2019, the final value of 9.819% is relatively close to the 5% indicated by international norms as the maximum. Furthermore, the immense market capitalization value of Costco could be responsible for such deviation.

4.13 NVIDIA Corp.

Nvidia Corp. (NASDAQ: NVDA) was founded in 1993 by Jensen Huang, Chris Malachowsky and Curtis Priem. Headquartered in Santa Clara, California, the company engages in the manufacturing and development of graphics processing units (GPUs). Nvidia has grown exponentially becoming a

leading company in fields such as visual computing, datacenter, artificial intelligence, gaming and cryptocurrency mining.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating NVIDIA from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

NVIDIA Corp Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.2951	0.2971	0.3353	0.4144
Long Term Debt Capacity Indicator	0.7857	0.7809	0.7405	0.7182
Current Ratio	7.6737	7.9435	8.0268	4.6926
Quick Ratio	7.1250	6.7584	7.3365	4.2561
Working Capital Indicator	1.1344	1.1331	1.0900	0.9397
Interest Coverage Indicator	54.73	65.58	52.62	33.39
Financial Leverage Indicator	1.4187	1.4228	1.5046	1.7079
Profitability Indicators				
Net Profit Margin	0.2560	0.3534	0.3136	0.2410
Financial Profitability	0.2291	0.4432	0.4078	0.2891
Return on Assets	0.1614	0.3115	0.2710	0.1692
Gross Profit Indicator	0.6198	0.6120	0.5993	0.5879
Assets Turnover Indicator	0.6305	0.8814	0.8641	0.7021
Management Performance Indicators				
Financial Expense Significance Indicator	0.0047	0.0049	0.0062	0.0083
Importance of General and Administrative Expenses indicator	0.1001	0.0845	0.0838	0.0959

Table 14: NVDA Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows a great values throughout the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes great values throughout the examined time period, meaning that this company could easily pay twice its current liabilities in case of liquidation.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows a substandard first year followed by great values from 2017 to 2019, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has great values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. Furthermore, a negative progression can be observed from 2016 to 2019. However, NVIDIA is of the largest companies in its field by market capitalization and thus it is understandable for its annual revenue to be overshadowed by its total assets.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, in addition to the negative progression from 2016 to 2019, the final value of 10.010% is over two times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of NVIDIA could be responsible for such deviation.

4.14 Amgen Inc.

Amgen (NASDAQ: AMGN) was established in 1980 by William K. Bowes and his associates. Headquartered in Thousand Oaks, California, the company focuses on treating and curing diseases. Its most successful products include Epogen (treats low red blood cell counts) and Neupogen (supports cancer patients' immune systems) and their development resulted in making Amgen one of the biggest independent biopharmaceutical companies in the world.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Amgen from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Amgen Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.8379	0.8117	0.6843	0.6151
Long Term Debt Capacity Indicator	0.2063	0.2361	0.3558	0.4497
Current Ratio	1.4366	2.7889	5.4851	4.1065
Quick Ratio	1.1574	2.5710	5.1709	3.8615
Working Capital Indicator	2.5418	1.4069	1.4337	1.4436
Interest Coverage Indicator	7.50	7.37	7.64	7.77
Financial Leverage Indicator	6.1725	5.3132	3.1676	2.5983
Profitability Indicators				
Net Profit Margin	0.3356	0.3534	0.0866	0.3358
Financial Profitability	0.8107	0.6715	0.0784	0.2584
Return on Assets	0.1313	0.1263	0.0247	0.0994
Gross Profit Indicator	0.8135	0.8273	0.8219	0.8189
Assets Turnover Indicator	0.3912	0.3575	0.2857	0.2961
Management Performance Indicators				
Financial Expense Significance Indicator	0.0551	0.0586	0.0570	0.0548
Importance of General and Administrative Expenses indicator	0.2204	0.2245	0.2131	0.2201

Table 15: AMGN Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has substandard values during most of the examined time period, meaning that this company is being encumbered with loans and other liabilities to third parties. Furthermore, a negative progression can be observed from 2016 to 2019.

The Long Term Debt Capacity Indicator shows substandard values throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Furthermore, a steep negative progression can be observed from 2016 to 2019.

The Current Ratio takes great values during most of the examined time period, meaning that this company could pay twice its current liabilities in case of liquidation. However, there is a negative progression from 2016 to 2019 with a substandard value of 1.43669 in 2019. Nevertheless, the final value indicates the company's ability to pay off its liabilities with a 43.669% remainder of its market value.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has good values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Amgen is of the largest companies in its field by market capitalization and thus it is understandable for its annual revenue to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes substandard values throughout the examined time period, meaning this company has significant financial expenses. Furthermore, a negative progression can be observed from 2016 to 2019. However, all values are between five and six percent, which is extremely close to the maximum of 5% indicated by international norms.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, in addition to the negative progression from 2016 to 2019, the final value of 22.044% is over four times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Amgen could be responsible for such deviation.

4.15 PayPal Holdings Inc.

PayPal Holdings Inc. (NASDAQ: PYPL) was founded in 1999 by Max Levchin, Peter Thiel, and Luke Nosek under the name Confinity. At first, the company engaged in the development of security software but quickly shifted into offering money-transfer services. Confinity merged with Elon

Musk's X.com and went public in 2002 under the name PayPal. After a short while, the company was bought by eBay for a reported $1.5 billion before parting with it in 2015. PayPal is a leading figure in digital payments thanks to its web and mobile app payment platforms.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating PayPal Holdings from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

PayPal Holdings Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.6702	0.6449	0.6077	0.5555
Long Term Debt Capacity Indicator	0.6928	0.8828	0.8929	0.9067
Current Ratio	1.4300	1.2725	1.4278	1.5246
Quick Ratio	1.4300	1.2725	1.4278	1.5246
Working Capital Indicator	0.6330	0.5287	0.5486	0.6305
Interest Coverage Indicator	24.26	32.50	n/a	n/a
Financial Leverage Indicator	3.0401	2.8163	2.5493	2.2500
Profitability Indicators				
Net Profit Margin	0.1383	0.1331	0.1370	0.1292
Financial Profitability	0.1456	0.1336	0.1122	0.0952
Return on Assets	0.0479	0.0474	0.0440	0.0423
Gross Profit Indicator	0.4494	0.4604	0.4811	0.4741
Assets Turnover Indicator	0.3462	0.3565	0.3211	0.3275
Management Performance Indicators				
Financial Expense Significance Indicator	0.0064	0.0049	0	0
Importance of General and Administrative Expenses indicator	0.2924	0.1788	0.1743	0.1841

Table 16: PYPL Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has good values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties. Nevertheless, a negative progression can be observed that results in moderate values for the final year.

The Long Term Debt Capacity Indicator shows great values throughout the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes substandard values during most of the examined time period, meaning that this company couldn't pay twice its current liabilities in case of liquidation. Furthermore, there is a negative progression from 2016 to 2019 with a substandard value of 1.43003 in 2019. Nevertheless,

the final value indicates the company's ability to pay off its liabilities with a 43.003% remainder of its market value.

The Quick Ratio Indicator has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows substandard values throughout the examined time period, meaning that the assets of this company do not come entirely from fixed funds (total stockholder's equity plus total non-current liabilities). However, a positive progression can be observed from 2016 to 2019.

The Interest Coverage Indicator has great values from 2018 to 2019, meaning that this company can repay the interest of foreign capital from its profits with great ease. During the first to years the indicator could not be calculated since the Interest Expense (denominator) is equal to zero.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has moderate values throughout the examined time period, meaning that this company gets to keep a decent percentage of every dollar it makes. Furthermore, there is a positive progression from 2016 to 2019.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, PayPal is of the largest companies in its field by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.


Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, in addition to the negative progression from 2016 to 2019, the final value of 29.242% is over five times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of PayPal could be responsible for such deviation.

4.16 Gilead Sciences Inc.

Gilead Sciences Inc. (NASDAQ: GILD) was founded by Michael L. Riordan in 1987 and is headquartered in Foster, California. One of the largest biopharmaceutical companies in the world, the company engages in the research and development of medicines in specific areas with medical deficiencies. It offers a variety of antiviral products that can be used against immunodeficiency viruses, liver diseases, respiratory diseases e.tc. These products are offered under brands like Harvoni, Genvoya, Epclusa, Truvada, Atripla and many more.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Gilead Sciences from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Gilead Sciences Inc Financial Indicators
Calculated by finance.yahoo.com data
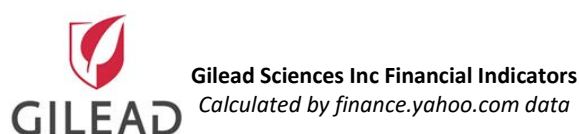
	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.6324	0.6618	0.7083	0.6601
Long Term Debt Capacity Indicator	0.4353	0.4041	0.3489	0.3994
Current Ratio	3.1044	3.3791	2.7351	2.2177
Quick Ratio	3.0099	3.3024	2.6662	2.0455
Working Capital Indicator	1.7079	1.4768	1.8410	2.3126
Interest Coverage Indicator	4.30	7.61	12.63	18.29
Financial Leverage Indicator	2.7359	2.9772	3.4381	3.0167
Profitability Indicators				
Net Profit Margin	0.2399	0.2465	0.1772	0.4442
Financial Profitability	0.2391	0.2550	0.2263	0.7148
Return on Assets	0.0873	0.0856	0.0658	0.2369
Gross Profit Indicator	0.7917	0.7806	0.8325	0.8597
Assets Turnover Indicator	0.3642	0.3474	0.3714	0.5333
Management Performance Indicators				
Financial Expense Significance Indicator	0.0443	0.0486	0.0428	0.0317
Importance of General and Administrative Expenses indicator	0.1951	0.1833	0.1485	0.1118

Table 17: GILD Financial Indicators 2016-2019

<u>Solvency Indicators</u>

The Total Debt Capacity Indicator has good values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties. Furthermore, a positive progression can be observed from 2016 to 2019.

The Long Term Debt Capacity Indicator shows substandard values throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Nevertheless, a positive progression can be observed from 2016 to 2019.

The Current Ratio takes great values throughout the examined time period, meaning that this company could pay twice its current liabilities in case of liquidation.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has great good throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. Furthermore, a negative progression can be observed from 2016 to 2019. However, Gilead is of the largest companies in its field by market capitalization and thus it is understandable for its annual revenue to be overshadowed by its total assets.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, in addition to the negative progression from 2016 to 2019, the final value of 19.515% is over three times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Gilead could be responsible for such deviation.

4.17 Texas Instruments Inc.

Texas Instruments Inc. (NASDAQ: TXN) was founded in 1930 by Cecil H. Green, Patrick Eugene Haggerty, John Erik Jonsson and Eugene McDermott. Headquartered in Dallas, Texas, the company engages in the development and production of semiconductor solutions for analog, digital embedded and application processing. Texas Instruments Inc. ranks among the top ten semiconductor companies in the world based on revenue.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Texas Instruments from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Texas Instruments Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.5056	0.4751	0.4140	0.3626
Long Term Debt Capacity Indicator	0.5603	0.6133	0.6719	0.7392
Current Ratio	4.1267	3.2728	3.8680	3.2937
Quick Ratio	3.1841	2.3767	3.0013	2.5030
Working Capital Indicator	1.8142	1.8109	1.761	1.8998
Interest Coverage Indicator	35.14	56.27	83.73	63.78
Financial Leverage Indicator	2.0229	1.9053	1.7066	1.5688
Profitability Indicators				
Net Profit Margin	0.3488	0.3535	0.2461	0.2688
Financial Profitability	0.5632	0.6204	0.3561	0.3432
Return on Assets	0.2784	0.3256	0.2087	0.2187
Gross Profit Indicator	0.6371	0.6511	0.6426	0.6163
Assets Turnover Indicator	0.7982	0.9210	0.8480	0.8137
Management Performance Indicators				
Financial Expense Significance Indicator	0.0118	0.0079	0.0052	0.0059
Importance of General and Administrative Expenses indicator	0.1143	0.1066	0.1132	0.1321

Table 18: TXN Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Dept Capacity Indicator shows great values throughout the examined time period, meaning that this company has minimal long-term liabilities in comparison to its stockholder's equity.

The Current Ratio takes great values throughout the examined time period, meaning that this company could easily pay twice its current liabilities in case of liquidation.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has great values throughout the examined time period, meaning that this company gets to keep a high percentage of every dollar it makes.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. Furthermore, a negative progression can be observed from 2016 to 2019. However, Texas Instruments is of the largest companies in its field by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. Furthermore, despite the positive progression from 2016 to 2019, the final value of 11.437% is over two times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization value of Texas Instruments could be responsible for such deviation.

4.18 Charter Communications Inc.

Charter Communications Inc. (NASDAQ: CHTR) was founded in 1993 by Barry Babcock, Jerald Kent and Howard Wood. Headquartered in Stamford, Connecticut, the company provides broadband

communications services including Spectrum Voice, TV and Internet. Charter Communications also offers video and music entertainment services and its production and advertisement services are provided by the Spectrum Reach brand.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Charter Communications from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Charter Communications Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.7380	0.6970	0.6758	0.6621
Long Term Debt Capacity Indicator	0.2448	0.2878	0.3075	0.3105
Current Ratio	0.5224	0.2257	0.2303	0.3447
Quick Ratio	0.5224	0.2257	0.2303	0.3447
Working Capital Indicator	19.8480	46.1714	49.7401	39.1721
Interest Coverage Indicator	n/a	n/a	n/a	n/a
Financial Leverage Indicator	4.7126	4.0272	3.7514	3.7137
Profitability Indicators				
Net Profit Margin	0.0364	0.0281	0.2379	0.1214
Financial Profitability	0.0530	0.0338	0.2531	0.0877
Return on Assets	0.0112	0.0084	0.0674	0.0236
Gross Profit Indicator	0.3614	0.3615	0.3617	0.3567
Assets Turnover Indicator	0.3088	0.2985	0.2835	0.1945
Management Performance Indicators				
Financial Expense Significance Indicator	0	0	0	0
Importance of General and Administrative Expenses indicator	0.0068	0.0065	0.0062	0.0309

Table 19: CHTR Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has good values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties. Nevertheless, a negative progression can be observed that results in moderate values for the final three years.

The Long Term Debt Capacity Indicator shows substandard values throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Furthermore, a negative progression can be observed from 2016 to 2019.

The Current Ratio takes substantial values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. Furthermore, despite the

positive progression from 2016 to 2019, the final value of 0.52248 indicates that the company's liabilities outweigh its market value.

The Quick Ratio has substandard values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets. However, there is a positive progression from 2016 to 2019.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator could not be calculated since the Interest Expense (denominator) is equal to zero throughout the examined time period.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has mixed values throughout the examined time period, meaning that this company doesn't always get to keep a high percentage of every dollar it makes. There is a steep negative progression from 2016 to 2019 with the final value of 3.644% being extremely substandard.

The Financial Profitability takes great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets has great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Charter Communications is of the largest companies in its field by market capitalization and thus it is understandable for its annual revenue company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows great values throughout the examined time period, meaning that this company has insignificant general and administrative expenses.

4.19 Tesla Inc.

Tesla Inc. (NASDAQ: TSLA) was founded by Elon Musk, Jeffrey Straubel, Martin Eberhard, and Marc Tarpenning in 2003. Headquartered in Palo Alto, California, the company engages in the development, production and sale of electric vehicles, efficient batteries and energy generation systems. Tesla also offers energy storage products for home and utility usage as well as solar electricity to its customers. The company is considered the best in the fully electric automotive industry due to the cutting-edge technology and self-driving capabilities of its vehicles.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Tesla from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Tesla Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.7823	0.8063	0.8173	0.7556
Long Term Debt Capacity Indicator	0.2903	0.2603	0.2120	0.2960
Current Ratio	1.1346	0.8312	0.8561	1.0742
Quick Ratio	0.8016	0.5196	0.5611	0.7194
Working Capital Indicator	1.8832	2.2769	3.0413	2.5642
Interest Coverage Indicator	0.11	-0.38	-3.46	-3.35
Financial Leverage Indicator	5.1841	6.0406	6.7627	4.7684
Profitability Indicators				
Net Profit Margin	-0.0350	-0.0454	-0.1668	-0.0964
Financial Profitability	-0.1302	-0.1982	-0.4628	-0.1420
Return on Assets	-0.0251	-0.0328	-0.0684	-0.0297
Gross Profit Indicator	0.1655	0.1883	0.1890	0.2284
Assets Turnover Indicator	0.7163	0.7216	0.4103	0.3088
Management Performance Indicators				
Financial Expense Significance Indicator	0.0278	0.0308	0.0400	0.0284
Importance of General and Administrative Expenses indicator	0.1076	0.1320	0.2106	0.2045

Table 20: TSLA Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has substandard values throughout the examined time period, meaning that this company is being encumbered with loans and other liabilities to third parties. Furthermore, a negative progression can be observed that results in moderate values for the final two years.

The Long Term Debt Capacity Indicator shows substandard values throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Furthermore, a negative progression can be observed from 2016 to 2019.

The Current Ratio takes substantial values throughout the examined time period, meaning that this company could not pay twice its current liabilities in case of liquidation. However, there is a positive progression from 2016 to 2019 with a final value of 1.13462 which indicates the company's ability to pay off its liabilities with a 13.462% remainder of its market value.

The Quick Ratio has substandard values throughout the examined time period, meaning that liabilities of this company can't be met by its financial assets. However, a positive progression can be observed from 2016 to 2019.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has substandard values throughout the examined time period, meaning that this company can't repay the interest of foreign capital from its profits with ease. However, there is a positive progress from 2016 to 2019.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has substandard values throughout the examined time period, meaning that this company gets to keep a low percentage of every dollar it makes. However, there is a positive progress from 2016 to 2019.

The Financial Profitability takes substandard values throughout the examined time period, meaning that this company has proven unsuccessful in using shareholder funds to achieve satisfactory results. However, a positive progression can be observed from 2016 to 2019.

The Return on Assets has substandard values throughout the examined time period, meaning that this company does not generate high profits in comparison to its assets. However, a positive progression can be observed from 2016 to 2019.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Tesla is of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019 with a final value of 71.637% which is significantly higher than the 30.886% value of 2016.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values throughout the examined time period, meaning this company produces revenues which dwarf its financial expenses.

The General & Administrative Expense Importance Indicator shows substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. However, a positive progression can be observed from 2016 to 2019 with the final value of 10.765% being significantly lower than the 20.459% value of 2016. Furthermore, the technological nature and immense market capitalization value of Tesla could be responsible for such deviation from international norms.

4.20 Broadcom Inc.

Broadcom Inc. (NASDAQ: AVGO) was founded in 1961 by Henry Samueli and Henry Nicholas. The company engages in the development, manufacturing and sale of infrastructure and semiconductor software solutions. It provides data center, telecom, embedded and enterprise networking applications as well as mainframe and storage networking solutions. Headquartered in San Jose, California, Broadcom is one of the world's largest semiconductor companies.

The following table shows the selected financial analysis indicators for solvency, performance and performance-management relating Broadcom from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

Broadcom Inc Financial Indicators
Calculated by finance.yahoo.com data

	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.6300	0.4681	0.5739	0.5621
Long Term Debt Capacity Indicator	0.4120	0.5578	0.4468	0.4665
Current Ratio	1.4374	3.8952	6.2566	2.3148
Quick Ratio	1.3107	3.4144	5.6844	1.8599
Working Capital Indicator	6.1101	5.2471	3.2793	6.5807
Interest Coverage Indicator	2.89	8.54	5.87	1.00
Financial Leverage Indicator	2.7029	1.8803	2.3470	2.2840
Profitability Indicators				
Net Profit Margin	0.1205	0.5880	0.0959	-0.1313
Financial Profitability	0.1090	0.4598	0.0729	-0.0794
Return on Assets	0.0403	0.2445	0.0310	-0.0348
Gross Profit Indicator	0.5524	0.5148	0.4824	0.4486
Assets Turnover Indicator	0.3348	0.4159	0.3240	0.2649
Management Performance Indicators				
Financial Expense Significance Indicator	0.0639	0.0301	0.0257	0.0441
Importance of General and Administrative Expenses indicator	0.0756	0.0506	0.0446	0.0608

Table 21: AVGO Financial Indicators 2016-2019

Solvency Indicators

The Total Debt Capacity Indicator has great values throughout the examined time period, meaning that this company is not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator shows mostly substandard values throughout the examined time period, meaning that this company has substantial long-term liabilities in comparison to its stockholder's equity. Furthermore, a negative progression can be observed from 2016 to 2019.

The Current Ratio takes mostly great values throughout the examined time period, meaning that this company could pay twice its current liabilities in case of liquidation. However, there is a negative progression from 2016 to 2019 with a final value of 1.43745 which indicates the company's ability to pay off its liabilities with a 43.745% remainder of its market value.

The Quick Ratio has great values throughout the examined time period, meaning that liabilities of this company can be met by its financial assets.

The Working Capital Indicator shows great values throughout the examined time period, meaning that the assets of this company come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has good values throughout the examined time period, meaning that this company can repay the interest of foreign capital from its profits with great ease. Furthermore, there is a positive progress from 2016 to 2019.

The Financial Leverage Indicator takes great values throughout the examined time period, meaning that this company utilizes loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has mixed values throughout the examined time period, meaning that this company doesn't always keep a high percentage of every dollar it makes. However, there is an impressive progression from 2016 to 2019 resulting in a moderate value.

The Financial Profitability takes mostly great values throughout the examined time period, meaning that this company has proven successful in using shareholder funds to achieve satisfactory results. Although a substandard value can be observed in the first year, a positive progression results in great values for the upcoming years.

The Return on Assets has mostly great values throughout the examined time period, meaning that this company has the ability to generate high profits in comparison to its assets. Although a substandard value can be observed in the first year, a positive progression results in great values for the upcoming years.

The Gross Profit Indicator takes great values throughout the examined time period, meaning that this company shows capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in this company in relation to its revenue. However, Broadcom is of the largest companies in its field by market capitalization and thus it is understandable for the annual revenue of this company to be overshadowed by its total assets. Furthermore, a positive progression can be observed from 2016 to 2019.

Management Performance Indicators

The Financial Expense Significance Indicator takes great values from 2016 to 2018, meaning this company produces revenues which dwarf its financial expenses. However, a slight increase in 2019 results in a substandard value for this indicator during the final year.

The General & Administrative Expense Importance Indicator shows mostly substandard values throughout the examined time period, meaning that this company has significant general and administrative expenses. However, despite the negative progression from 2016 to 2019, the final value of 7.562% is relatively close to the 5% indicated by international norms as the maximum. Furthermore, the technological nature and immense market capitalization value of Broadcom could be responsible for such deviation.

4.21 Nasdaq-100 Weighted Indicator Averages

In order to perform financial analysis and calculate indicators for solvency, performance and performance-management, information such as balance sheets and income statements must be available. Since the Nasdaq-100 is an index and not a company, such data does not exist.

However, a subset of the twenty largest companies listed on this index was financially analyzed with the required indicators for each one of them having been calculated. With the financial indicators of those companies known, the twenty-company average of each indicator could be determined. The selected companies constitute 71.035% of the capital contained in the Nasdaq-100 and thus their performance as an average approximates to the greatest degree the performance of the index.

At the same time, a company's market capitalization is directly proportional to its effect on the index, meaning that some companies have greater influence on the index's value than others. It is therefore safe to assume, that a simple twenty-company average for every indicator may not be enough to produce reliable results. To resolve this issue and based on its market capitalization, each company was assigned a weight coefficient proportionally related to its percentage in the index's pool share.

$$Index\ Weight = \frac{Market\ Capitalization\ of\ Company}{Total\ Market\ Capitalization\ of\ All\ Companies\ Listed\ on\ this\ Index}$$

The index weight of every company was calculated using the above equation, by taking in to account every company listed on the Nasdaq-100. In order to convert each weight to the selected subset of twenty companies, an additional computation was required in order to upscale the previous results.

$$Subset\ Weight = \frac{Index\ Weight}{Percentage\ of\ Index\ Capital\ that\ the\ Selected\ Companies\ Constitute}$$

The following table shows the index and subset weight for each one of the twenty companies chosen to be financially analyzed.

Company	Symbol	Index Weight	Subset Weight
Microsoft Corp	MSFT	11.630%	16.372%
Apple Inc	AAPL	11.305%	15.915%
Amazon.com Inc	AMZN	10.159%	14.301%
Alphabet Inc	GOOG & GOOGL	8.165%	11.494%
Facebook Inc	FB	3.999%	5.630%
Intel Corp	INTC	2.823%	3.974%
Comcast Corp	CMCSA	2.145%	3.020%
Cisco Systems Inc	CSCO	2.138%	3.010%
Netflix Inc	NFLX	2.065%	2.907%
PepsiCo Inc	PEP	2.052%	2.889%
Adobe Inc	ADBE	2.024%	2.849%
Costco Wholesale Corp	COST	1.817%	2.558%
NVIDIA Corp	NVDA	1.783%	2.510%
Amgen Inc	AMGN	1.584%	2.230%
PayPal Holdings Inc	PYPL	1.441%	2.029%
Gilead Sciences Inc	GILD	1.312%	1.847%
Texas Instruments Inc	TXN	1.292%	1.819%
Charter Communications Inc	CHTR	1.130%	1.591%
Tesla Inc	TSLA	1.091%	1.536%
Broadcom Inc	AVGO	1.080%	1.520%

Table 22: Nasdaq-100 Subset Weight Coefficients as of 20/03/2020

The financial indicators of the Nasdaq-100 have all been determined (per year) using the equation below.

$$V = \sum_{i=1}^{20} wi * vi$$

where:

- **V**, represents the value of the index indicator (i.e., Net Profit Margin of Nasdaq-100)
- **vi**, represents the indicator value of company "i" (i.e., Net Profit Margin of Microsoft Corp for i=1, Net Profit Margin of Apple Inc for i=2, etc. for all twenty companies)
- **wi**, represents the subset weight of company "i" (i.e., Subset Weight of Microsoft Corp for i=1, Subset Weight of Apple Inc for i=2, etc. for all twenty companies)
- **i**, is used as a representation of the twenty different companies in the chosen subset

The following table shows the twenty-company weighted averages of each indicator for solvency, performance and performance-management relating the Nasdaq-100 index from 2016 to 2019. The table cells corresponding to indicator values have been color coded based on the acceptable price range of each indicator. Green cells indicate great values while yellow and red ones stipulate moderate and substandard values respectively.

NASDAQ-100 Weighted Indicator Averages	29-09-2019	29-09-2018	29-09-2017	29-09-2016
Solvency Indicators				
Total Debt Capacity Indicator	0.5983	0.5880	0.5803	0.5450
Long Term Debt Capacity Indicator	0.5335	0.5381	0.5382	0.5978
Current Ratio	2.1110	2.4429	3.0103	2.8899
Quick Ratio	1.9865	2.3045	2.8769	2.7787
Working Capital Indicator	2.2728	2.6673	2.6387	2.4268
Interest Coverage Indicator	122.62	202.55	233.59	108.16
Financial Leverage Indicator	2.9923	2.9789	3.0478	2.7412
Profitability Indicators				
Net Profit Margin	0.1951	0.1858	0.1637	0.1682
Financial Profitability	0.3200	0.3002	0.2148	0.2147
Return on Assets	0.1145	0.1155	0.0867	0.0931
Gross Profit Indicator	0.5193	0.5206	0.5164	0.5163
Assets Turnover Indicator	0.7361	0.7637	0.7072	0.7597
Management Performance Indicators				
Financial Expense Significance Indicator	0.0143	0.0142	0.0132	0.0108
Importance of General and Administrative Expenses indicator	0.1624	0.1569	0.1606	0.1660

Table 23: Nasdaq-100 Weighted Indicator Averages as of 20/03/2020

Solvency Indicators

The Total Debt Capacity Indicator of the Nasdaq-100 has great values throughout the examined time period, meaning that the companies of this index are not being encumbered with loans and other liabilities to third parties.

The Long Term Debt Capacity Indicator of the Nasdaq-100 takes great values throughout the examined time period, meaning that the companies of this index have minimal long-term liabilities in comparison to their stockholder's equity.

The Current Ratio shows great values throughout the examined time period, meaning that the companies of this index could pay twice their current liabilities in case of their liquidation.

The Quick Ratio Indicator has great values throughout the examined time period, meaning that liabilities of the companies listed on this index can be met by their financial assets.

The Working Capital Indicator takes great values throughout the examined time period, meaning that the assets of the companies listed on this index come entirely from fixed funds (total stockholder's equity plus total non-current liabilities).

The Interest Coverage Indicator has great values throughout the examined time period, meaning that the companies of this index can repay the interest of foreign capital from their profits with great ease.

The Financial Leverage Indicator of the Nasdaq-100 takes great values throughout the examined time period, meaning that the companies of this index utilize loaned funds successfully in order to generate profits.

Profitability Indicators

The Net Profit Margin has moderate values throughout the examined time period. However, there is a positive progression from 2016 to 2019 with the final value of 19.51% being extremely close to 20% which is considered great. Nasdaq-100 is also a tech-based index and the tech industry allows for lower values of this indicator due to the need for initial investments required to develop software. Therefore, and in accordance to international norms, the values of this indicator show that the companies of the Nasdaq-100 get to keep a high percentage of every dollar they make.

The Financial Profitability of the Nasdaq-100 takes great values throughout the examined time period, meaning that the companies listed on this index have proven successful in using shareholder funds to achieve satisfactory results.

The Return on Assets of the Nasdaq-100 has great values throughout the examined time period, meaning that the companies of this index have the ability to generate high profits in comparison to their assets.

The Gross Profit Indicator of the Nasdaq-100 takes great values throughout the examined time period, meaning that the companies of this index show capable operational efficiency and effectiveness in pricing policies.

The Assets Turnover Indicator of the Nasdaq-100 has substandard values throughout the examined time period, meaning that there is an overinvestment of capital in the companies listed on this index in relation to their revenue. Furthermore, there is a negative progression from 2016 to 2019. However, this index lists some of the largest companies in the world by market capitalization and thus it is understandable for the annual revenue of those companies to be overshadowed by their total assets.

Management Performance Indicators

The Financial Expense Significance Indicator of the Nasdaq-100 takes great values throughout the examined time period, meaning that the companies listed on this index have revenues which dwarf their financial expenses.

The General & Administrative Expense Importance Indicator of the Nasdaq-100 has substandard values throughout the examined time period, meaning that the companies of this index have significant general and administrative expenses. Furthermore, despite the positive progression from 2016 to 2019 and the final value of 16.24%, these expenses are over three times higher than the maximum of 5% indicated by international norms. However, the technological nature and immense market capitalization of most companies listed on the Nasdaq-100 could be responsible for such deviation.

5. Technical Indicators

In order to perfect the timing of their transactions and augment their profits, investors can use technical analysis indicators. These indicators do not examine any part of the fundamental business, like revenue, earnings or profit margins. They are mathematical calculations that aim to predict the future price movement of an asset by analyzing the past performance of its price or volume. Technical Indicators are primarily designed to analyze short-term price movements and thus, they are mostly used by active traders rather than long-term investors. The main categories of Technical Analysis Indicators are the following (Brown, 1999, Schwager, 1999, Murphy, 1999):

- Momentum Oscillators
- Trend Indicators
- Volatility Indicators
- Volume Indicators

An experienced investor will use indicators of different categories in correlation to one another in order to achieve the best results. More specifically, when indicators of different categories suggest the same action, there is a much higher probability their prediction will come to fruition.

5.1 Momentum Oscillators

These indicators compute the speed of price movement by comparing closing prices over a specific period of time (Naved & Srivastava, 2015). Usually, these indicators appear as a separate figure below the price chart of the examined security. When a divergence between the price and momentum indicators occurs, a change in the direction of future prices is possible. Momentum Oscillator values can indicate the following signals:

- OVERBOUGHT, when it is believed the security is being traded above its current value
- BUY, when the value of the security is expected to increase
- NEUTRAL, when no valid results can be obtained
- SELL, when the value of the security is expected to decrease
- OVERSOLD, when it is believed the security is being traded below its current value

I.   Relative Strength Index (RSI)

The Relative Strength Index is a widely used momentum oscillator developed in 1978 by J. Welles Wilder. It provides signals about the direction of price momentum by generating values from 0 to 100. The RSI range values and their corresponding signals based on international norms are as follows:

- OVERBOUGHT, when values are included in the (70, 100] interval
- BUY, when values are included in the [55, 70] interval
- NEUTRAL, when values are included in the (45, 55) interval
- SELL, when values are included in the [30, 45] interval
- OVERSOLD, when values are included in the [0, 30) interval

This indicator is computed with a two-part calculation since it requires a smoothed average of n-periods. The standard is to use 14 periods in order to calculate the initial RSI value. For the first n-periods (14) the RSI is computed using the following equation:

$$RSI = 100 - \left[\frac{100}{1 + \frac{Average\ Gain}{Average\ Loss}} \right]$$

After successfully calculating the indicator for the first 14 periods, the RSI of all later periods can be computed using the equation below:

$$RSI = 100 - \left[\frac{100}{1 + \frac{(Previous\ Average\ Gain \times 13) + Current\ Gain}{-((Previous\ Average\ Loss \times 13) + Current\ Loss)}} \right]$$

The following figure shows the Relative Strength Index plotted beneath price graph of the Nasdaq-100 Index. The purple line represents the indicator's value whereas the dashed lines indicate overbought and oversold limits. When the purple line crosses below the "seventy" dashed line (upper) it is considered a Sell signal, whereas when it crosses above the "thirty" dashed line (lower) it is considered a Buy signal.
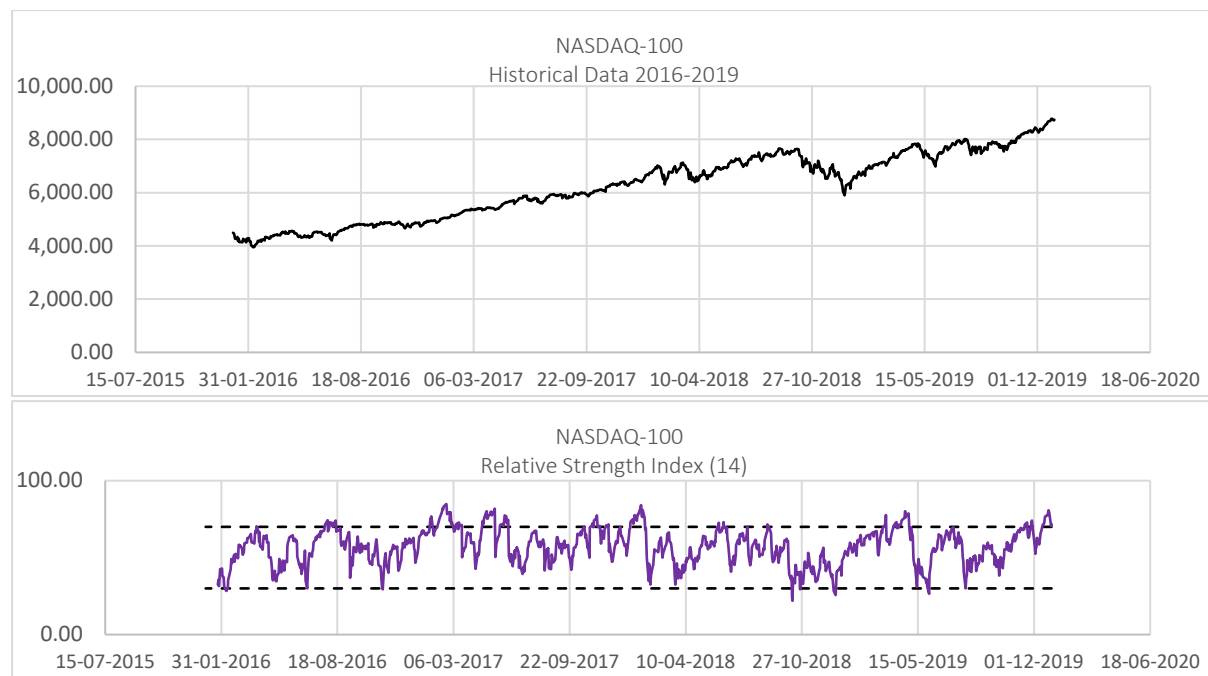

Figure 1: Nasdaq-100 Relative Strength Index (14)

II.   Stochastic Oscillator (STOCH)

The Stochastic Oscillator is a is a widely used momentum oscillator developed in the late 1950s by George Lane. It provides signals about the direction of price momentum by generating values from 0 to 100. The Stochastic Oscillator range values and their corresponding signals based on international norms are as follows:

- OVERBOUGHT, when values are included in the (80, 100] interval
- BUY, when values are included in the [55, 80] interval
- NEUTRAL, when values are included in the (45, 55) interval
- SELL, when values are included in the [20, 45] interval
- OVERSOLD, when values are included in the [0, 20) interval

The Stochastic Oscillator consists of two variables; the fast stochastic and the slow stochastic. Additional price data is required for a n-period prior to the first time the indicator is computed. The standard is to examine the 14 previous periods in order to calculate the fast stochastic oscillator using the following equation:

$$\%K = \left(\frac{C - L14}{H14 - L14}\right) \times 100$$

where:

- **%K**, represents the current value of the fast stochastic oscillator
- **C**, represents the most recent closing price
- **L14**, represents the lowest closing price of the 14 previous trading sessions
- **H14**, represents the highest closing price of the 14 previous trading sessions

Having calculated the fast stochastic, the slow stochastic oscillator can then be computed using the equation below:

$$\%D = \left(\sum_{i=1}^{3} \%K\right) \div 3$$

where:

- **%D**, represents the current value of the slow stochastic oscillator
- **%K**, represents the current value of the fast stochastic oscillator

The following figure shows the Stochastic Oscillator plotted beneath price graph of the Nasdaq-100 Index. When both %K and %D are above the "eighty" dashed line (upper) it is considered a Sell signal, whereas when they are both below the "twenty" dashed line (lower) it is considered a Buy signal. Furthermore, the %K line crossing above the %D line would be a Buy signal while crossing below it would be a Sell signal.
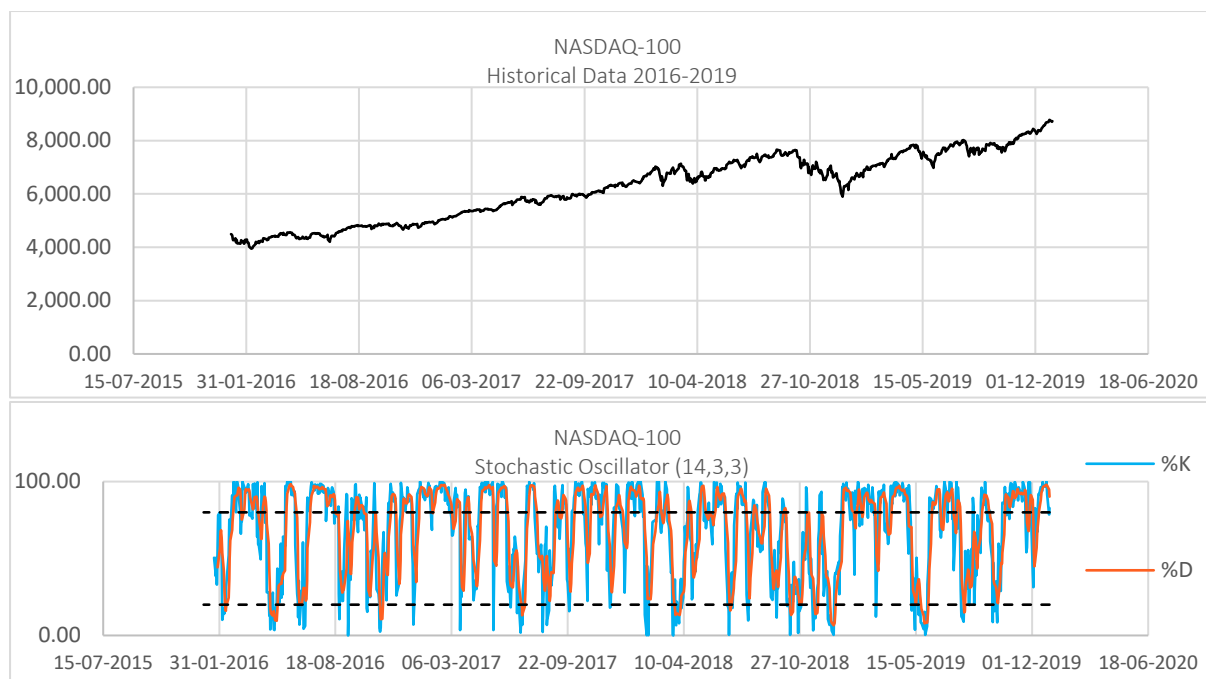
Figure 2: Nasdaq-100 Stochastic Oscillator (14,3,3)

III.   Williams %R Indicator

The Williams %R Indicator is a momentum oscillator developed by Larry Williams. It provides signals about the direction of price momentum by generating values between 0 and -100. The Williams %R Indicator range values and their corresponding signals based on international norms are as follows:

- OVERBOUGHT, when values are included in the (-20, 0] interval
- BUY, when values are included in the [-45, -20] interval
- NEUTRAL, when values are included in the (-55, -45) interval
- SELL, when values are included in the [-80, -55] interval
- OVERSOLD, when values are included in the [-100, -80) interval

Additional price data is required for a n-period prior to the first time the indicator is computed. The standard is to examine the 14 previous periods in order to calculate the Williams %R Indicator using the following equation:

$$Williams\ \%R = \frac{Highest\ High - Close}{Highest\ High - Lowest\ Low}$$

where:

- **Highest High**, represents highest price in the lookback period of 14 days
- **Close**, represents the most recent closing price
- **Lowest Low**, represents lowest price in the lookback period of 14 days

The following figure shows the Williams %R Indicator plotted beneath price graph of the Nasdaq-100 Index. The blue line represents the indicator's value whereas the dashed lines indicate overbought and oversold limits. When the blue line crosses below the "negative twenty" dashed line (upper) it is considered a Sell signal, whereas when it crosses above the "negative eighty" dashed line (lower) it is considered a Buy signal.
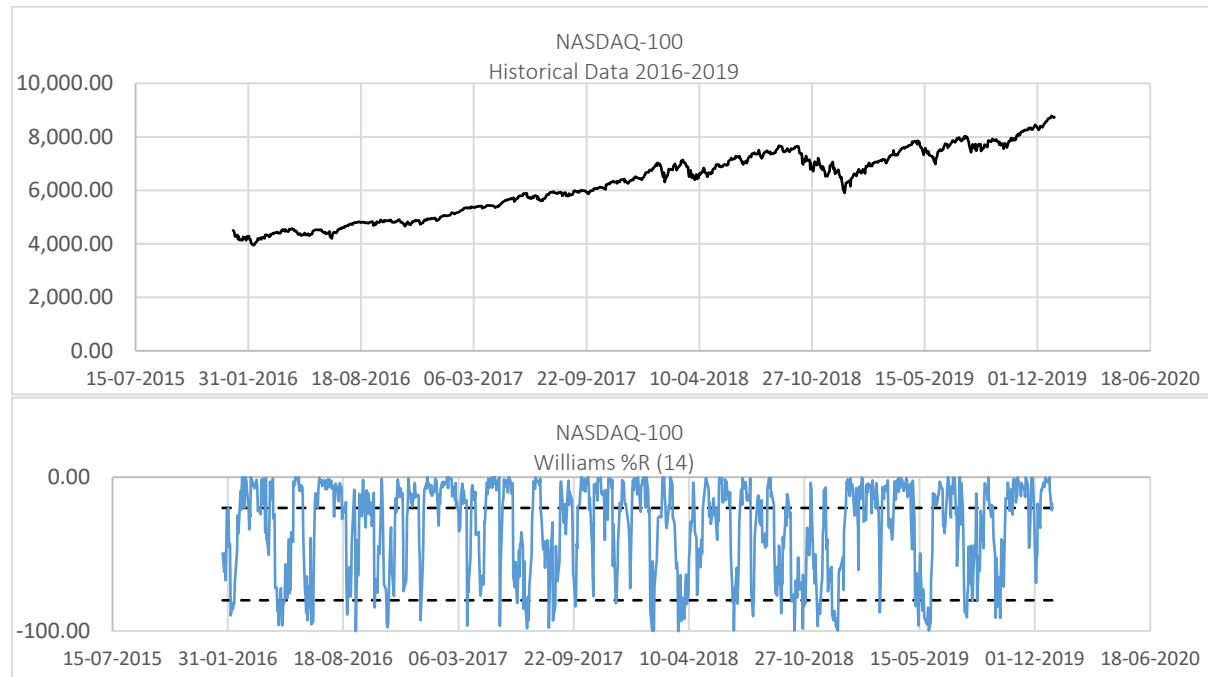

Figure 3: Nasdaq-100 Williams %R Indicator (14)

IV. Commodity Channel Index (CCI)

The Commodity Channel Index was developed by Donald Lambert in 1980. This oscillator measures the difference between the historical average price and the current price. Values above zero indicate the price is above the historic average, whereas values below zero indicate the price is below the historic average. This indicator is unbounded, meaning that the overbought and oversold limits should be set individually for each asset by examining the extreme values. The Commodity Channel Index range values and their corresponding signals based on international norms are as follows:

- OVERBOUGHT, when values are included in the (200, + ∞) interval
- BUY, when values are included in the [50, 200] interval
- NEUTRAL, when values are included in the (-50, 50) interval
- SELL, when values are included in the [-200, -50] interval
- OVERSOLD, when values are included in the (-200, -∞) interval

Additional price data is required for a n-period prior to the first time the indicator is computed. The standard is to examine the 20 previous periods in order to calculate the Commodity Channel Index using the following equation:

$$CCI = \frac{Typical\ Price - MA}{0.015 \times Mean\ Deviation}$$

where:

- **Typical Price** $= \sum_{i=1}^{20}\left((High + Low + Close) \div 3\right)$
- **MA** $= \left(\sum_{i=1}^{20} Typical\ Price\right) \div 20$
- **Mean Deviation** $= \left(\sum_{i=1}^{20}| Typical\ Price - MA |\right) \div 20$

The following figure shows the Commodity Channel Index plotted beneath price graph of the Nasdaq-100 Index. The yellow line represents the indicator's value whereas the dashed lines indicate overbought and oversold limits. When the yellow line crosses below the "two hundred" dashed line (upper) it is considered a Sell signal, whereas when it crosses above the "negative two hundred" dashed line (lower) it is considered a Buy signal.
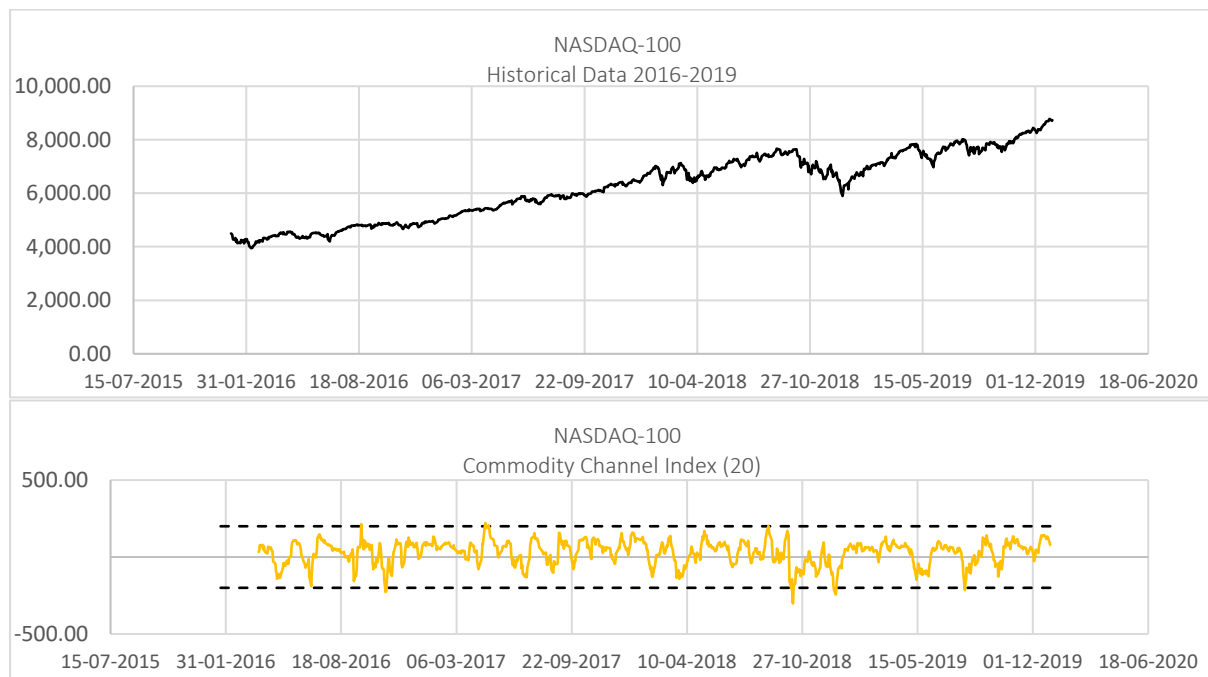

Figure 4: Nasdaq-100 Commodity Channel Index (20)

V.   Ultimate Oscillator (ULTOSC)

The Ultimate Oscillator was developed in 1976 by Larry Williams. This indicator uses three different time frames (7, 14 and 28 periods) to measure the price momentum of an asset by generating values between 0 and 100. The shorter the time frame, the most weight it has in the calculation. The Ultimate Oscillator range values and their corresponding signals based on international norms are as follows:

- OVERBOUGHT, when values are included in the (70, 100] interval
- BUY, when values are included in the [55, 70] interval
- NEUTRAL, when values are included in the (45, 55) interval
- SELL, when values are included in the [30, 45] interval
- OVERSOLD, when values are included in the [0, 30) interval

Additional price data is required for a 28-period (longest of the three periods required) prior to the first time the indicator is computed. In order to calculate the Ultimate Oscillator using the following equation:

$$ULTOSC = \left[\frac{(Average7 \times 4) + (Average14 \times 2) + Average28}{4 + 2 + 1} \right]$$

where:

- **Buying Pressure** $= Close - Min(Low, Prior\ Close)$
- **True Range** $= Max(High, Prior\ Close) - Min(Low, Prior\ Close)$
- **Average7** $= \frac{\sum_{p=1}^{7} Buying\ Pressure}{\sum_{p=1}^{7} True\ Range}$
- **Average14** $= \frac{\sum_{p=1}^{14} Buying\ Pressure}{\sum_{p=1}^{14} True\ Range}$
- **Average28** $= \frac{\sum_{p=1}^{28} Buying\ Pressure}{\sum_{p=1}^{28} True\ Range}$

The following figure shows the Ultimate Oscillator plotted beneath price graph of the Nasdaq-100 Index. The red line represents the indicator's value whereas the dashed lines indicate overbought and oversold limits. When the yellow line crosses below the "seventy" dashed line (upper) it is considered a Sell signal, whereas when it crosses above the "thirty" dashed line (lower) it is considered a Buy signal.
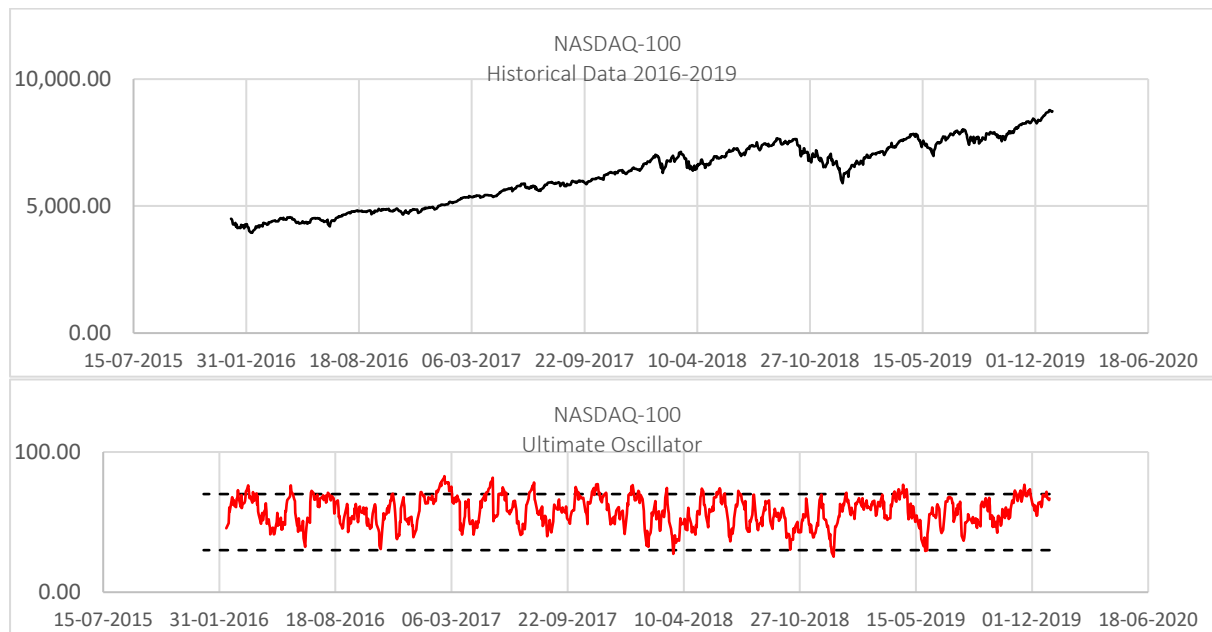

Figure 5: Nasdaq-100 Ultimate Oscillator

Price Rate of Change Indicator (ROC)

The Price Rate of Change Indicator was developed in 2001 by Konstantin Kopyrkin. It is an unbounded indicator that measures momentum against a zero-level midpoint. Unlike the previous momentum oscillators, the ROC does not provide Overbought and Oversold signals. The Price Rate of Change Indicator range values and their corresponding signals based on international norms are as follows:

- BUY, when values are positive
- NEUTRAL, when values are equal to zero
- SELL, when values are negative

Additional price data is required for a n-period prior to the first time the indicator is computed. The standard is to examine the 9 previous periods in order to calculate the Price Rate of Change Indicator using the following equation:

$$ROC = \left(\frac{Closing\ Price - Closing\ Price9}{Closing\ Price9} \right) \times 100$$

where:

- **Closing Price**, represents the closing price of the most recent period
- **Closing Price9**, represents the closing price 9 periods before the most recent period

The following figure shows the Price Rate of Change Indicator plotted beneath price graph of the Nasdaq-100 Index. The turquoise line represents the indicator's value and when it crosses above the "zero" line it is considered a Buy signal. Contrariwise, when it crosses below the "zero" line it is considered a Sell signal.
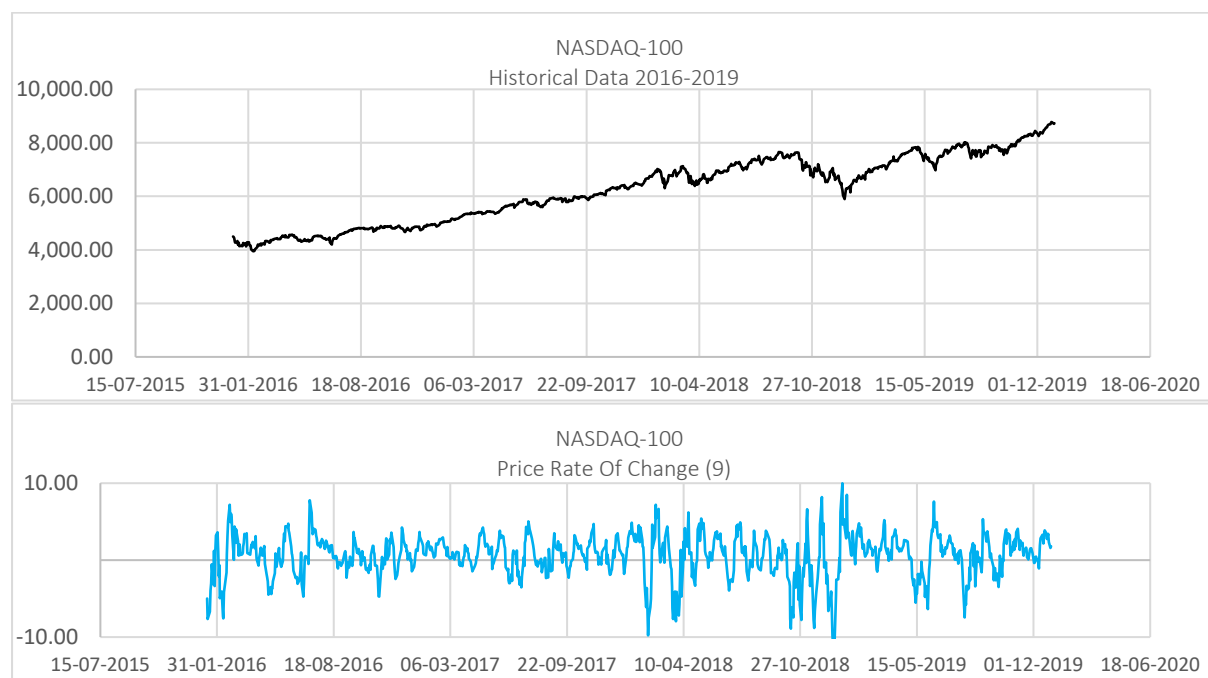

Figure 6: Nasdaq-100 Price Rate of Change Indicator (9)

5.2 Trend Indicators

These indicators measure the strength of a trend using price averages as baselines. When the price moves higher than the established baseline, it can be thought of as a bullish trend (uptrend). Contrariwise, when the price falls below the baseline, it can be thought of as a bearish trend (downtrend). Trend Indicator values can give out the following signals:

- BUY, when the value of the security is expected to increase (expected bullish trend)
- NEUTRAL, when no valid results can be obtained
- SELL, when the value of the security is expected to decrease (expected bearish trend)

I.   Simple Moving Average (SMA)

Simple Moving Averages compute the average of a selected range of prices by the number of periods in that range. The values of this indicator serve as a baseline which will be compared to the price of the examined security. The Simple Moving Average values and their corresponding signals based on international norms are as follows:

- BUY, when the most recent closing price of the security is higher than the current SMA value
- NEUTRAL, when the most recent closing price of the security is equal to the current SMA value
- SELL, when the most recent closing price of the security is lower than the current SMA value

Additional price data is required for a n-period prior to the first time the indicator is computed. The formula for calculating Simple Moving Averages can be seen below:

$$SMA(n) = \frac{\sum_{i=1}^{n} Ci}{n}$$

where:

- **Ci**, represents the closing price of an asset at period i
- **n**, represents the number of total periods

The following figure shows the Simple Moving Averages for 10, 20, 50, 100 and 200 periods plotted on the price graph of the Nasdaq-100 Index. When the price of the Nasdaq-100 crosses above a Simple Moving Average line, it is considered a Buy signal. Contrariwise, when it crosses below a Simple Moving Average line it is considered a Sell signal.
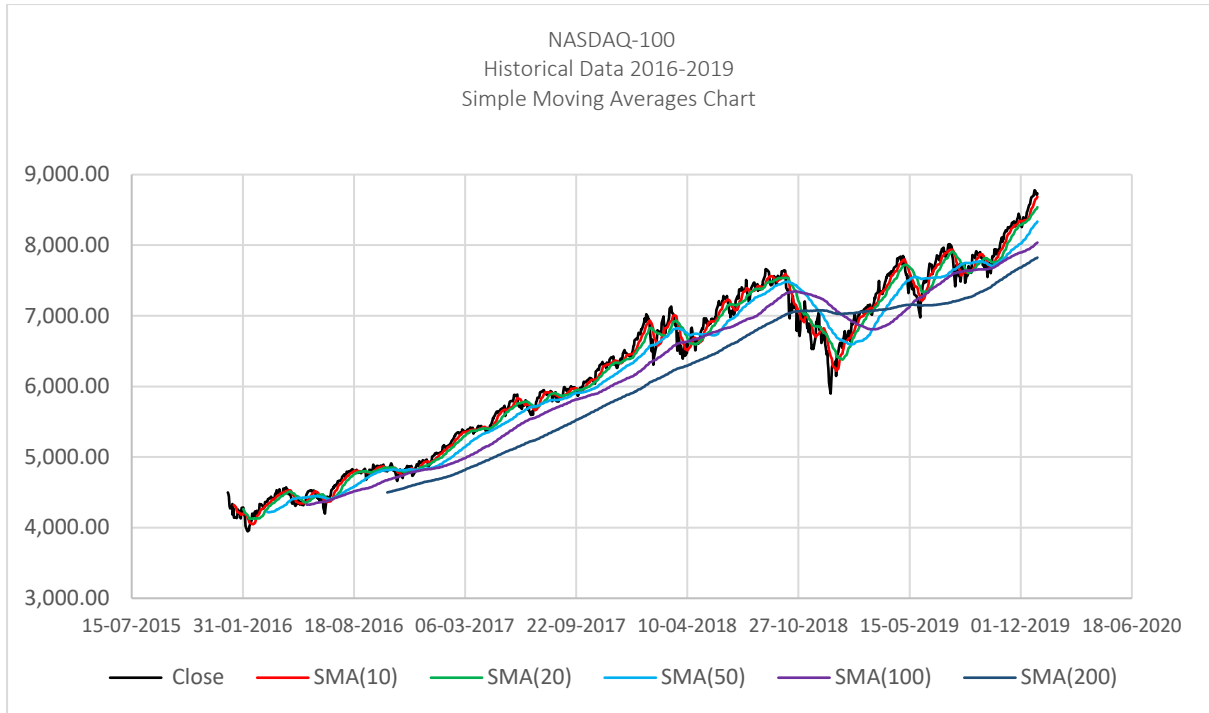
Figure 7: Nasdaq-100 Simple Moving Averages

II.   Exponential Moving Average (EMA)

Exponential Moving Averages are moving averages that place greater weight on most recent data points. The latter helps in making the indicator react faster to changes and give signals quicker than Simple Moving Averages. The values of this indicator serve as a baseline which will be compared to the price of the examined security. The Exponential Moving Average values and their corresponding signals based on international norms are as follows:

- BUY, when the most recent closing price of the security is higher than the current EMA value
- NEUTRAL, when the most recent closing price of the security is equal to the current EMA value
- SELL, when the most recent closing price of the security is lower than the current EMA value

The first time, the indicator is computed by averaging the closing values of the previous n-periods. For every following period, the formula for calculating Exponential Moving Averages can be seen below:

$$EMA(n) = \left(Close \times \left(\frac{Smoothing}{1+n} \right) \right) + PEMA \times \left(1 - \left(\frac{Smoothing}{1+n} \right) \right)$$

where:

- **Close**, represents the closing price of the current period
- **n**, represents the total number of periods
- $\boldsymbol{Smoothing = 2}$, represents the weight attributed to most recent data points
- **PEMA**, represents the EMA of the previous period

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The following figure shows the Exponential Moving Averages for 10, 20, 50, 100 and 200 periods plotted on the price graph of the Nasdaq-100 Index. When the price of the Nasdaq-100 crosses above an Exponential Moving Average line, it is considered a Buy signal. Contrariwise, when it crosses below an Exponential Moving Average line it is considered a Sell signal.
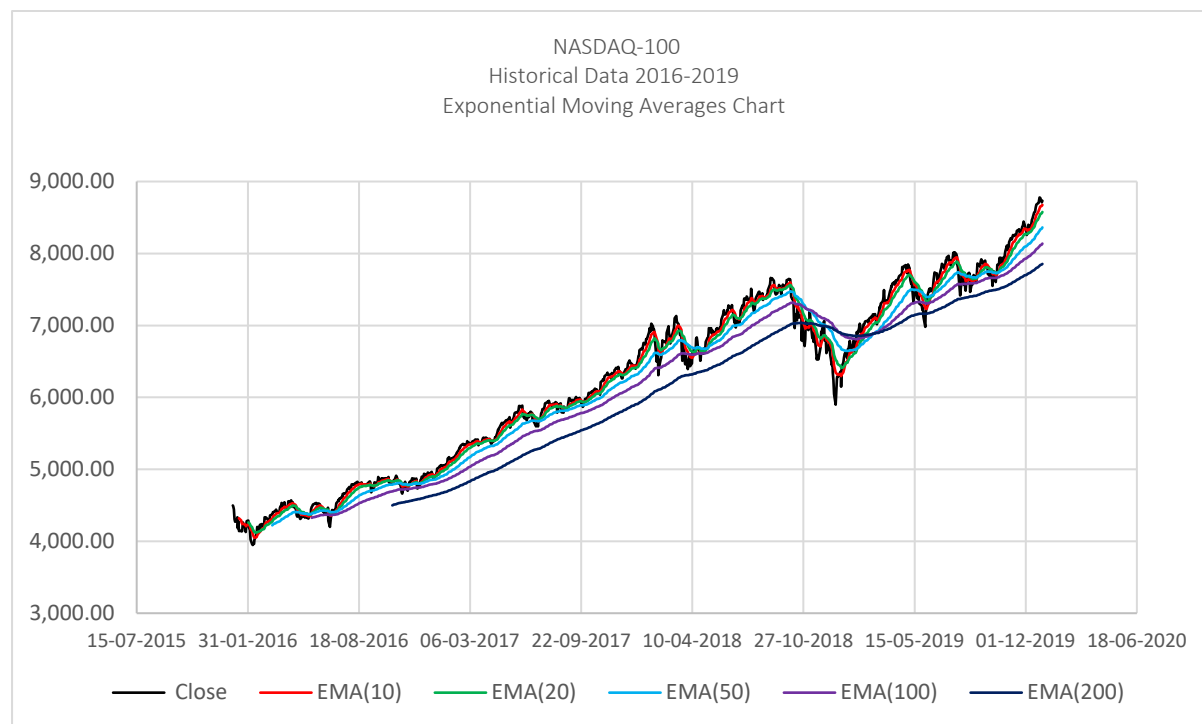

Figure 8: Nasdaq-100 Exponential Moving Averages

III. Moving Average Convergence Divergence (MACD)

The Moving Average Convergence Divergence is a trend indicator developed towards the end of the 1970s by Gerald Appel. It is computed by subtracting a 26-period Exponential Moving Average from a 12-period one. Furthermore, the graph of this indicator also features a signal line which is calculated by a 9-period EMA of the indicator's value. The Moving Average Convergence Divergence values and their corresponding signals based on international norms are as follows:

- BUY, when values are positive
- NEUTRAL, when values are equal to zero
- SELL, when values are negative

The formula for calculating the Moving Average Convergence Divergence can be seen below:

$$MACD = EMA(12) - EMA(26)$$

where:

- **EMA (12)**, represents the Exponential Moving Average of the previous 12 periods.
- **EMA (26)**, represents the Exponential Moving Average of the previous 26 periods.

The following figure shows the Moving Averages Convergence Divergence plotted beneath the price graph of the Nasdaq-100 Index. When the MACD line crosses above the Signal line, it is considered a Buy signal. Contrariwise, when it crosses below the Signal line it is considered a Sell signal.
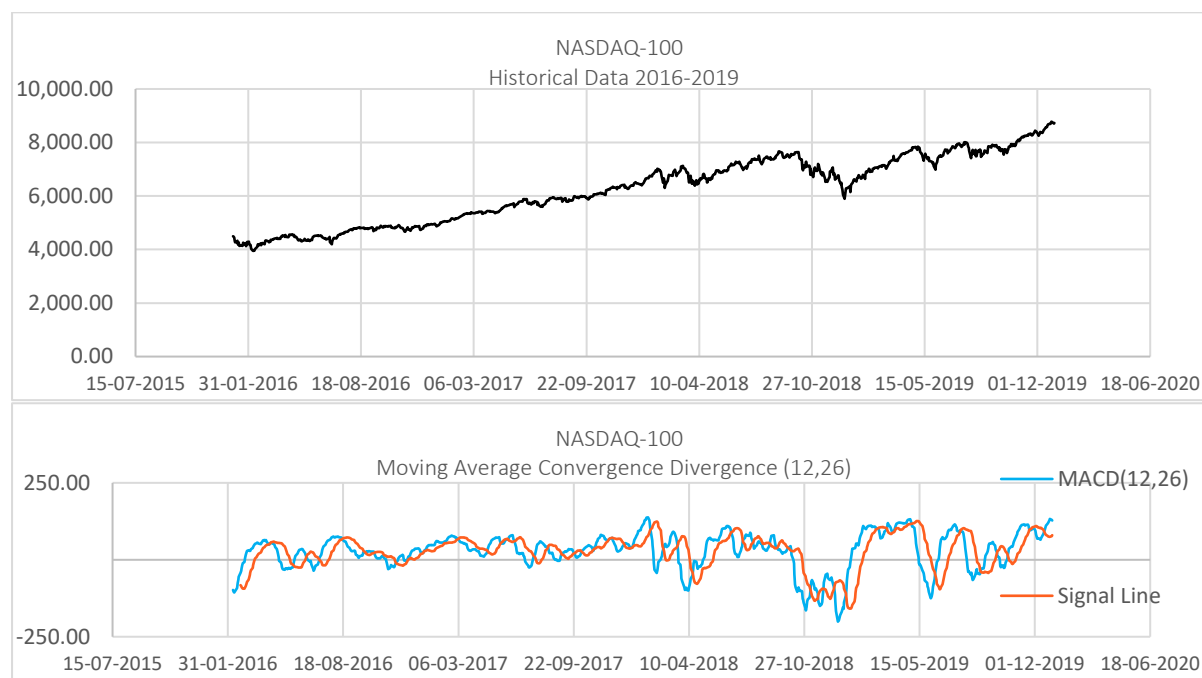

Figure 9: Nasdaq-100 Moving Average Convergence Divergence (12,26)

IV.   Average Directional Index (ADX)

The Average Directional Index is a trend indicator developed in 1978 by Welles Wilder. It features two different directional indicators, a positive (+DI) and a negative (-DI) one. The ADX's value is used to determine the strength of the trend while the directional indicators point to the trend's direction (bullish or bearish). Specifically, a trend is considered strong when the ADX is above 25 and weak when it is below 20. Furthermore, when the +DI is greater than the -DI, it is considered a bullish trend, whereas when the -DI is greater than the +DI, it is considered a bearish trend. The Moving Average Directional Index values and their corresponding signals based on international norms are as follows:

- BUY, when values are greater than 25 and +DI > -DI
- NEUTRAL, when values are included in the [0, 25] interval
- SELL, when values are greater than 25 and +DI < -DI

Additional price data is required for a n-period prior to the first time the indicator is computed. The standard is to examine the 14 previous periods in order to calculate the Average Directional Index using the following equations:

$$+DI = \left(\frac{+DXsmoothed}{ATR}\right) \times 100$$

$$-DI = \left(\frac{-DXsmoothed}{ATR}\right) \times 100$$

$$DX = \left(\frac{|(+DI) - (-DI)|}{|(+DI) + (-DI)|}\right) \times 100$$

$$ADX = \frac{(Prior\,ADX \times 13) + Current\,DX}{14}$$

where:

- $+DM = Current\,High - Previous\,High$
- $-DM = Previous\,Low - Current\,Low$
- $+DX = +DM, if\,(+DM > -DM\,and + DM > 0), else + DX = 0$
- $-DX = -DM, if\,(-DM > +DM\,and - DM > 0), else - DX = 0$
- $+DXsmoothed = \frac{(+DXsmoothedPrior \times 13) + (+DX)}{14}$, with the first calculation being an average of the previous fourteen +DX
- $-DXsmoothed = \frac{(-DXsmoothedPrior \times 13) + (-DX)}{14}$, with the first calculation being an average of the previous fourteen -DX
- $True\,Range = Max(High, Prior\,Close) - Min(Low, Prior\,Close)$
- $ATR = \frac{(PriorATR \times 13) + True\,Range}{14}$, with the first calculation being an average of the previous fourteen True Ranges
- $ADX(first\,calculation) = \frac{\sum_{i=1}^{14} DXi}{14}$

The following figure shows the Average Directional Index plotted beneath the price graph of the Nasdaq-100 Index. When the +DI line crosses above the -DI, it is considered a Buy signal. Contrariwise, when the -DI line crosses above the +DI, it is considered a Sell signal. However, these signals are only considered valid when the ADX has a value above 25.
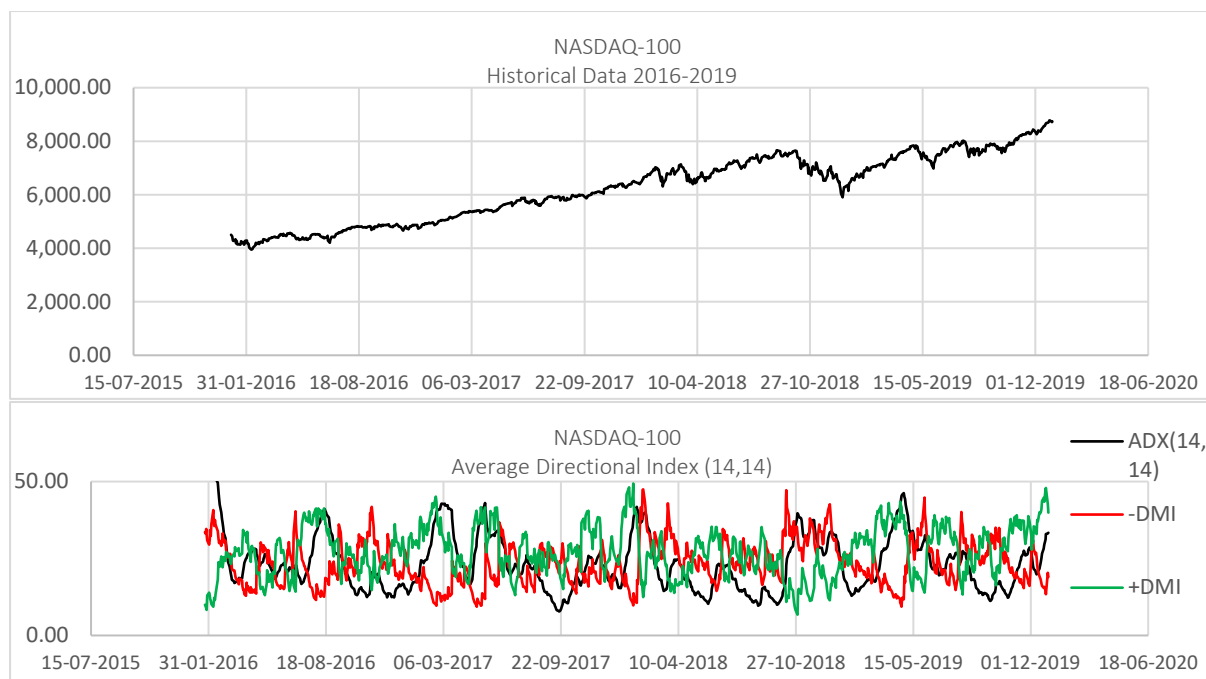
Figure 10: Nasdaq-100 Average Directional Index (14,14)

5.3 Volatility Indicators

These indicators measure the rate of price movement by comparing the highest and lowest point of an asset during a period of time. Volatility indicators provide useful information about how volatile the market is without indicating a future probable direction of the price, meaning that they do not indicate Buy or Sell signals. Higher volatility means that a security's value can change dramatically over a short period of time in either direction. Therefore, it is widely accepted that a market with low volatility is safer and thus preferable by investors. In some cases, volatility indicators could also hint Overbought and Oversold levels. Volatility Indicator values can give out the following signals:

- HIGH VOLATILITY, when big price swings occur during a short period of time
- NEUTRAL, when no valid results can be obtained
- LOW VOLATILITY, when no big price swings can be observed during a period of time

I.   Average True Range (ATR)

The Average True Range is a volatility indicator developed by Welles Wilder in 1978. It helps investors identify moments when investing is preferable based on the volatility of the market. The values of this indicator are not determined by international norms since they must be correlated with the examined security. The Average True Range Indicator values and their corresponding signals regarding the Nasdaq-100 Index are as follows:

- HIGH VOLATILITY, when values are greater than 120
- NEUTRAL, when values are included in the [90, 120] interval
- LOW VOLATILITY, when values are less than 90

Additional price data is required for a n-period prior to the first time the indicator is computed. The standard is to examine the 14 previous periods in order to calculate the Average True Range using the following equation:

$$ATR(n)EMA = \frac{True\ Range \times Smoothing}{n+1} + Previous\ ATR \times \left(1 - \frac{Smoothing}{n+1}\right)$$

where:

- **n**, represents the total number of periods
- $\boldsymbol{Smoothing = 2}$, represents the weight attributed to most recent data points
- $\boldsymbol{True\ Range = Max(High, Prior\ Close) - Min(Low, Prior\ Close)}$
- $\boldsymbol{ATR(n)first\ calculation = \frac{\sum_{i=1}^{n}(True\ Range\ of\ i\ period)}{n}}$

The following figure shows the Average True Range plotted beneath the price graph of the Nasdaq-100 Index. The red line represents the indicator's value and when it crosses above the "one hundred and twenty" gridline it is considered a High Volatility signal. Contrariwise, when it crosses below the "ninety" gridline it is considered a Low Volatility signal.
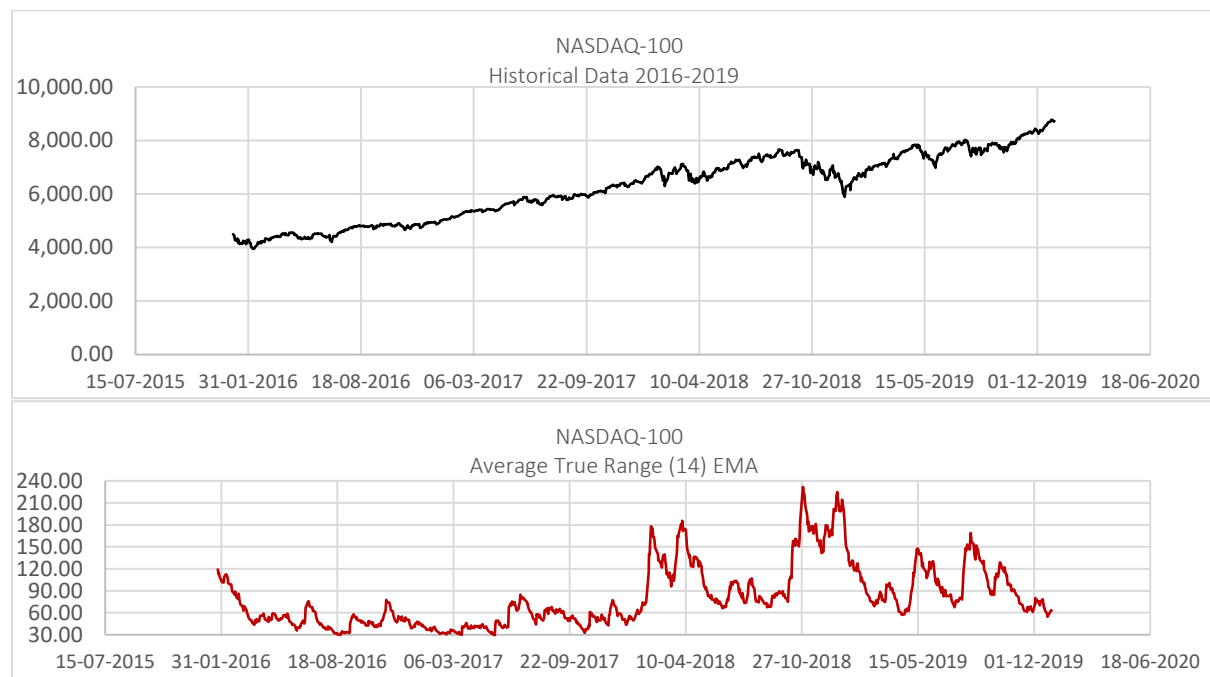

Figure 11: Nasdaq-100 Average True Range (14)

Bollinger Bands (BBANDS)

Bollinger Bands are volatility indicators developed by John Bollinger in 1980s. They help investors identify moments when investing is preferable based on the volatility of the market. This indicator is composed by three different lines; An Upper Band, a Lower Band and a Simple Moving Average. The Upper and Lower Bands are typically two standard deviations away from a 20-period moving average. When the Bands contract there is low volatility in the security's price movement whereas when the Bands expand, the volatility is high. The values of this indicator are not determined by international norms since they must be correlated with the examined security. The values of Bollinger Bands and their corresponding signals regarding the Nasdaq-100 Index are as follows:

- HIGH VOLATILITY, when the difference between Upper and Lower Bands is greater than 500
- NEUTRAL, when the difference between Upper and Lower Bands is equal to 50
- LOW VOLATILITY, when the difference between Upper and Lower Bands is lower than 500

Additional price data is required for a n-period prior to the first time the indicator is computed. The standard is to examine the 20 previous periods in order to calculate the Bollinger Bands using the following equations:

$$UBAND = SMA(Close, n) + m \times \sigma[Close, n]$$

$$LBAND = SMA(Close, n) - m \times \sigma[Close, n]$$

where:

- $n = 20$, represents the total number of periods
- $m = 2$, represents the number of Standard Deviations that the Bands are located above and below the Simple Moving Average
- $SMA(Close, n)$, represents the Simple Moving Average of the Closing price for the last n periods
- $\sigma[Close, n]$, represents the Standard Deviation of the Closing price over the last n periods
- $UBAND$, represents the Upper Bollinger Band
- $LBAND$, represents the Lower Bollinger Band

The following figure shows the Bollinger Bands Indicators plotted on the price graph of the Nasdaq-100 Index. A main concept about volatility is that periods of low volatility tend to be followed by periods of high volatility and vice versa. This notion suggests that when the Upper and Lower Bands start to pinch together, volatility will probably increase. Furthermore, when the price of a security moves above the Upper Band or below the Lower Band, it is considered to be Overbought or Oversold respectively. However, the price tends to usually move between the bounds.
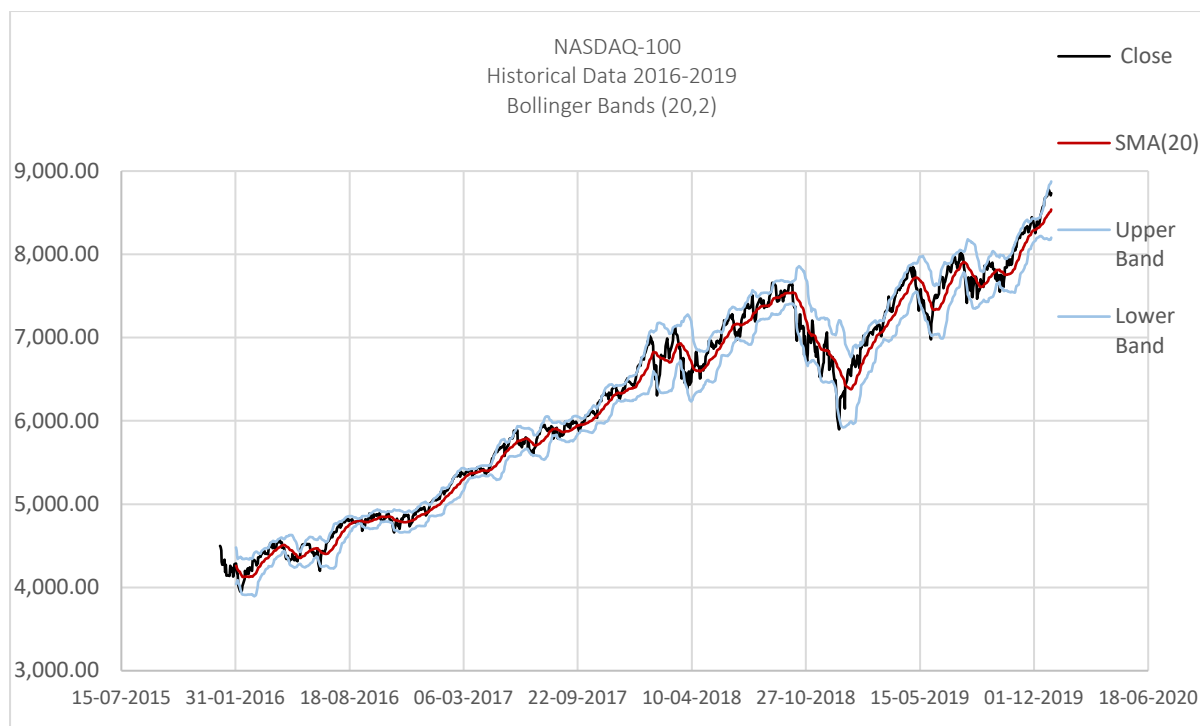
Figure 12: Nasdaq-100 Bollinger Bands (20,2)

5.4 Volume Indicators

Trading Volume is a measure of indicating how much of a given security (shares/contracts) has traded during a time period. Since Indices (e.g., Nasdaq-100) can only be traded through derivatives or exchange traded funds (ETFs) and not directly, volume data is unavailable and thus volume indicators can't be used on them. Most Volume Indicators do not provide clear Buy and Sell signals. However, when comparing the course of a plotted volume indicator with the security's price, occurring patterns may provide insight about the current trend's strength and indicate possible trend reversals. Specifically, the following assumptions can be made after observing a volume indicator chart:

- Rising prices on increasing volume typically point to strong and healthy securities with an expected increase in value
- Falling prices on increasing volume show that the bearish trend is strengthening
- When prices reach new highs or new lows on decreasing volume, it could mean that a trend reversal might be happening

I.   Chaikin Oscillator (CHIOSC)

The Chaikin Oscillator is a volume indicator developed by Marc Chaikin in the 1970s. This Indicator applies MACD to the accumulation-distribution line instead of the closing price (which is what the MACD trend indicator does). Specifically, this indicator is computed by subtracting a 10-day EMA of the accumulation-distribution line from a 3-day EMA of the accumulation-distribution line. The Chaikin Oscillator values and their corresponding signals based on international norms are as follows:

- BUY, when values are positive
- NEUTRAL, when values are equal to zero
- SELL, when values are negative

The Chaikin Oscillator can be calculated by using the following equations:

$$N = \frac{(Close - Low) - (High - Close)}{High - Low}$$

$$M(n) = N \times Volume(n)$$

$$ADL = M(n-1) + M(n)$$

$$CHIOSC = (3Day\ EMA\ of\ ADL) - (10Day\ EMA\ of\ ADL)$$

where:

- **n**, represents the current period
- **N**, represents the Money Flow Multiplier
- **M(n)**, represents the Money Flow Volume of the n-period
- **M(n-1)**, represents the Money Flow Volume of the period right before the n-period
- **ADL**, represents the Accumulation-Distribution Line
- **CHIOSC**, represents the Chaikin Oscillator

The figure showing the Chaikin Oscillator plotted beneath the price chart of the Nasdaq-100 is unavailable due to the fact that volume indicators can't be used for technical analysis on Indices. However, an example of this indicator being plotted beneath the price graph of General Electric Co. will be used to identify possible visual indications traders often consider as Buy or Sell Signals. When the indicator (black line) crosses above the zero line, it is considered a Buy signal. Contrariwise, when the black line crosses below the zero line, it is considered a Sell signal.
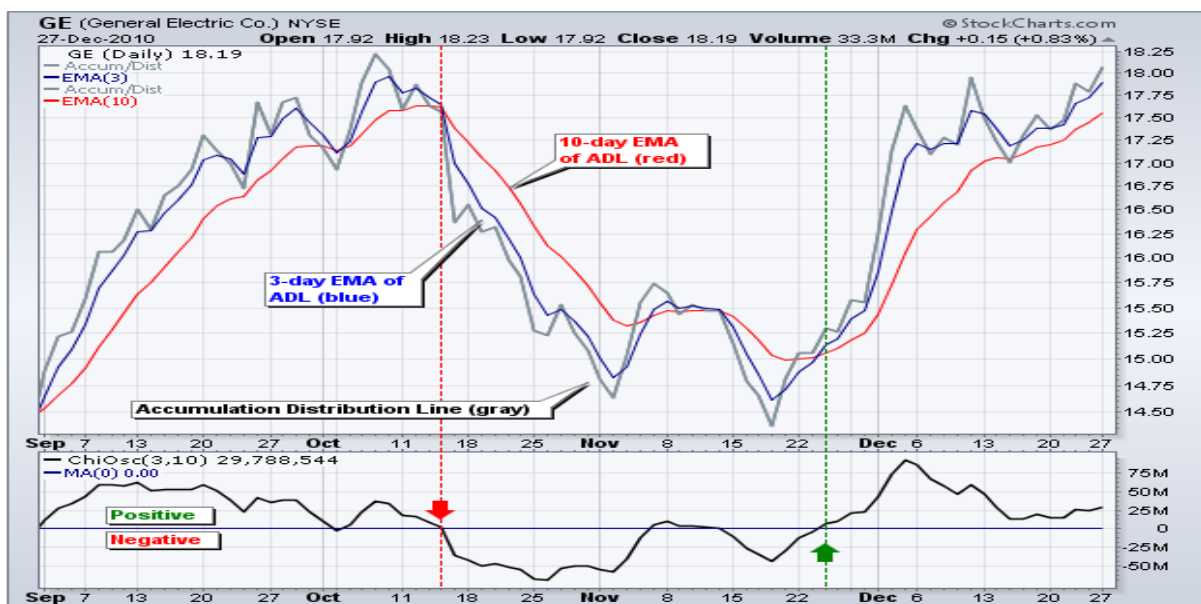

Figure 13: GE Chaikin Oscillator (3,10) by StockCharts.com

II.   On Balance Volume (OBV)

On Balance Volume is a momentum indicator that measures positive and negative volume flow. It was developed by Joseph Granville in 1963 and like other volume indicators it doesn't give out Buy and Sell signals. Investors can look for divergences between the indicator and a security's price in order to predict future values or confirm price trends. Specifically, the following assumptions can be made after comparing the On Balance Volume with an asset's price chart:

- Bullish trends followed by a rising OBV typically point to strong and healthy securities with an expected increase in value
- Bearish trends followed by a rising OBV signify that the bearish trend is strengthening
- When prices reach new highs or new lows with a falling OBV, it could mean that a trend reversal might be happening

The On Balance Volume can be calculated by using the following formula:

$$OBV = Previous\ OBV + \begin{cases} Volume, if\ Close > Previous\ Close \\ 0, if\ Close = Previous\ Close \\ -Volume, if\ Close < Previous\ Close \end{cases}$$

where:

- **Close**, represents the latest closing price of the security
- **Volume**, represents the latest trading volume amount of the security
- $\boldsymbol{OBV(first\ Calculation) = 0}$

The figure showing the On Balance Volume plotted beneath the price chart of the Nasdaq-100 is unavailable due to the fact that volume indicators can't be used for technical analysis on Indices. However, an example of this indicator being plotted beneath the price graph of Best Buy Co. will be used to identify possible visual indications which could be used to predict future price movement.

Figure 14: BBY On Balance Volume by StockCharts.com

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6. Assessment of Technical Analysis Indicators

A technical analysis was performed on the Nasdaq-100 from 2016 to 2019 in order to determine the most reliable technical indicators who can successfully predict future prices for this index. The indicator categories chosen to be included in this analysis were momentum oscillators and trend indicators. Volatility indicators were not included since they do not provide clear BUY and SELL signals to evaluate. Furthermore, volume indicators couldn't be used since volume data is unavailable for indices, including the Nasdaq-100.

In this thesis technical indicators were assessed individually. However, in order to achieve the best results an experienced investor will use a number of indicators in correlation to one another. Specifically, when indicators of different categories suggest the same action, there is a much higher probability their prediction will come true.

6.1 Description and Parameters of Simulation

Trend Indicators only show Buy and Sell signals so they were fairly easy to evaluate. However, momentum oscillators show Overbought, Buy, Sell and Oversold signals. By principle, when an asset is Overbought, its value is expected to fall whereas when it is Oversold, its value is expected to rise. Consequently, for all momentum oscillators, Overbought and Oversold signals were converted to Sell and Buy orders respectively.

Since some indicators might be more effective on short-term investments and others on long-term ones, their performance needed to be examined over different time periods. With the daily Nasdaq-100 price data available, the following time periods were chosen:

- Daily Period (One-day period)
- Weekly Period (Five-day period)
- Monthly Period (By month from January 2016 to December 2019)

Furthermore, two different scenarios were examined depending on if the trading platform requires a commission; one with 0% commission per transaction and one with 1.5% (commissions usually range between 1-2%).

In order to compare different Technical Analysis Indicators over different time periods, some basic parameters (equal for all indicators) needed to be established.

10. A BUY order is always executed at the closing price of the first period, even if the indicator suggests the opposite. This happens so that a common starting point is established for all indicators.
11. A SELL order is always executed at the closing price of the final period, even if the indicator suggests the opposite. This is only avoided if the security had been sold before the final period and no other investments were made up until then.
12. All NEUTRAL signals are deemed inconclusive and consequently no transactions are executed on them.
13. OVERBOUGHT and OVERSOLD signals are converted to SELL and BUY orders respectively.

14. Shorting is unavailable during this simulation meaning that no SELL orders will be executed without an existing investment. Shorting is strategy traders use to bet against the market and profit off of the decline in value. This complex method suggests selling an asset at the current price with the commitment of buying it back some time in the future. If price falls, then the buyback is cheaper and a profit is made.

15. During any investment, the full available amount is deposited or withdrawn meaning that BUY and SELL orders must alternate. Consecutive orders of the same type will be ignored until a different option is signaled by the indicator. An example (without commission) can be seen in the table below:

Date	Closing Price	Investment Value	Indicator	Transactions
10-01-2016	$23.00	$10,304.00	Sell	Sell Executed
09-01-2016	$25.00	$11,200.00	Buy	Buy Executed
08-01-2016	$20.00	$11,200.00	Sell	None
07-01-2016	$28.00	$11,200.00	Sell	Sell Executed
06-01-2016	$20.00	$10,000.00	Neutral	None
05-01-2016	$30.00	$10,000.00	Buy	None
04-01-2016	$25.00	$10,000.00	Buy	Buy Executed

Table 24: BUY and SELL Transaction Alternations Example

16. Every time a BUY order is executed, the following formula computes the current value of the investment:

$$CVB = S - S \times C$$

where:

- **S**, represents the entire amount available for investing
- **C**, represents the commission per transaction
- **CVB**, represents the current value of the investment after the deposit of funds

17. Every time a SELL order is executed, the following formula computes the current value of the investment:

$$CVS = CVBL + \left(\frac{D - W}{W}\right) \times CVBL - \left(CVBL + \left(\frac{D - W}{W}\right) \times CVBL\right) \times C$$

where:

- **CVBL**, represents the value the investment had after the last deposit of funds
- **D**, represents the value of the Security when the deposit was made
- **W**, represents the value of the Security during the withdrawal (current value)
- **C**, represents the commission per transaction
- **CVS**, represents the current value of the investment after the withdrawal of funds

18. The Profit or Loss is calculated using the equation below:

$$P/L(\%) = \frac{CVS(n) - A}{A} \times 100\%$$

where:

- **A**, represents the initial amount available for investing
- **n**, represents the final time period
- **CVS(n)**, represents the current value of the investment after the withdrawal of funds in the n-period

6.2 Indicator Rankings for Commission-Free Transactions

During this simulation, a total of $10,000.00 was invested in the Nasdaq-100 Index from 2016 to 2019 using eighteen different indicators following the predetermined parameters. Every transaction was performed under ideal conditions meaning that all investments were commission-free. Some indicator values couldn't be evaluated monthly because there wasn't enough data to perform the necessary calculations. The results for all indicators and time periods can be observed in the following table. The blue-colored cells represent the indicator-period pair that results in the highest profit for each of the selected indicators.

Technical Indicators	Category	Daily		Weekly		Monthly	
		Profit	Transactions	Profit	Transactions	Profit	Transactions
Ultimate Oscillator	Momentum Oscillator	38.51%	142	92.34%	28	104.08%	2
MACD (12,26)	Trend Indicator	31.75%	30	90.05%	4	104.08%	2
SMA (200)	Trend Indicator	69.43%	16	103.87%	2	N/A	0
EMA (200)	Trend Indicator	66.01%	14	103.87%	2	N/A	0
ADX (14,14)	Trend Indicator	9.59%	28	49.04%	8	99.50%	4
CCI (20)	Momentum Oscillator	58.28%	56	95.37%	4	N/A	0
SMA (100)	Trend Indicator	33.48%	40	92.85%	4	N/A	0
EMA (100)	Trend Indicator	44.05%	38	92.85%	4	N/A	0
EMA (10)	Trend Indicator	34.01%	160	61.94%	34	91.29%	6
EMA (50)	Trend Indicator	31.91%	72	90.17%	8	N/A	0
SMA (20)	Trend Indicator	39.83%	94	73.03%	14	87.04%	4
EMA (20)	Trend Indicator	55.37%	112	73.16%	16	87.04%	4
SMA (10)	Trend Indicator	33.16%	150	58.30%	32	86.15%	6
SMA (50)	Trend Indicator	36.21%	56	85.33%	8	N/A	0
RSI (14)	Momentum Oscillator	39.97%	116	70.30%	12	59.24%	4
ROC (9)	Momentum Oscillator	10.17%	154	67.32%	32	69.13%	6
STOCH (14,3,3)	Momentum Oscillator	32.08%	174	66.08%	28	64.12%	6
Williams %R (14)	Momentum Oscillator	19.06%	294	49.05%	60	37.76%	10

Table 25: Nasdaq-100 Indicator Rankings 0% Commission

The most reliable indicators for investing in the Nasdaq-100 are the Ultimate Oscillator and the Moving Average Convergence Divergence, with both of them examined over a monthly time period. An initial investment of $10,000.00 in 2016 using these indicators would result in $20,408.00 by the end of 2019. These returns are equivalent to an annual compound interest of 19.52% at a time period when the Lending Interest Rates of the United States averaged 4.45% per year. Overall, all indicators performed better in the weekly and monthly periods with 14 out of 18 producing profits greater than 85%. Nevertheless, the performance of most indicators is barely adequate when considering that the price of the Nasdaq-100 rose 94.16% during the examined time period. However, in real scenarios, skilled investors would use a variety of Technical Analysis indicators in order to perform a single transaction when they all give out the same signal. The latter would result in much higher returns while limiting the number of transactions (important when trading on commission).

6.3 Indicator Rankings for Transactions with Commission

During this simulation, a total of $10,000.00 was invested in the Nasdaq-100 Index from 2016 to 2019 using eighteen different indicators following the predetermined parameters. Every transaction was performed under real conditions meaning that all investments had a 1.5% commission per transaction. Some indicator values couldn't be evaluated monthly because there wasn't enough data to perform the necessary calculations. The results for all indicators and time periods can be observed in the following table. The blue-colored cells represent the indicator-period pair that results in the highest profit for each of the selected indicators.

Technical Indicators	Category	Daily		Weekly		Monthly	
		Profit	Transactions	Profit	Transactions	Profit	Transactions
Ultimate Oscillator	Momentum Oscillator	-83.80%	142	25.98%	28	98.01%	2
MACD (12,26)	Trend Indicator	-16.28%	30	78.90%	4	98.01%	2
SMA (200)	Trend Indicator	33.04%	16	97.80%	2	N/A	0
EMA (200)	Trend Indicator	34.35%	14	97.80%	2	N/A	0
ADX (14,14)	Trend Indicator	-28.22%	28	32.07%	8	87.79%	4
CCI (20)	Momentum Oscillator	-32.10%	56	83.91%	4	N/A	0
SMA (100)	Trend Indicator	-27.08%	40	81.53%	4	N/A	0
EMA (100)	Trend Indicator	-18.89%	38	81.53%	4	N/A	0
SMA (20)	Trend Indicator	-66.22%	94	40.03%	14	76.07%	4
EMA (20)	Trend Indicator	-71.41%	112	35.97%	16	76.07%	4
EMA (10)	Trend Indicator	-88.06%	160	-3.13%	34	74.71%	6
SMA (10)	Trend Indicator	-86.20%	150	-2.40%	32	70.01%	6
EMA (50)	Trend Indicator	-55.57%	72	68.51%	8	N/A	0
SMA (50)	Trend Indicator	-41.57%	56	64.22%	8	N/A	0
ROC (9)	Momentum Oscillator	-89.25%	154	3.16%	32	54.46%	6
RSI (14)	Momentum Oscillator	-75.75%	116	42.06%	12	49.90%	4
STOCH (14,3,3)	Momentum Oscillator	-90.48%	174	8.78%	28	49.90%	6
Williams %R (14)	Momentum Oscillator	-98.60%	294	-39.81%	60	18.44%	10

Table 26: Nasdaq-100 Indicator Rankings 1.5% Commission

The most reliable indicators for investing in the Nasdaq-100 are the Ultimate Oscillator and the Moving Average Convergence Divergence, with both of them examined over a monthly time period. An initial investment of $10,000.00 in 2016 using these indicators would result in $19,801.00 by the end of 2019. These returns are equivalent to an annual compound interest of 18.63% at a time period when the Lending Interest Rates of the United States averaged 4.45% per year. Overall, all indicators performed better in the weekly and monthly periods with 12 out of 18 producing profits greater than 70%. Nevertheless, the performance of most indicators is barely adequate when considering that the price of the Nasdaq-100 rose 94.16% during the examined time period. Furthermore, 16 out of 18 indicators posed losses in the daily period due to the fact that more transactions on commission were executed. However, in real scenarios, skilled investors would use a variety of Technical Analysis indicators in order to perform a single transaction when they all give out the same signal. The latter would result in much higher returns while limiting the number of transactions (important when trading on commission).

7. Conclusions & Recommendations

The Financial Analysis which was performed on the twenty largest Nasdaq-100 components from 2016 to 2019 showed that the companies listed on this index have excellent solvency, financial profitability and management performance. Almost all financial indicator values were great with a few exceptions in the financial performance and management performance categories. However, these substandard values were due to the technological nature and immense market capitalization value of most companies listed on the Nasdaq-100. Therefore, the Financial Analysis concluded that the Nasdaq-100 features healthy companies with immense growth potential and thus any investment will surely produce significant profits.

The Technical Analysis which was performed on the Nasdaq-100 individually assessed eighteen different indicators in order to show the which ones could more accurately predict the future price movement of this Index. Furthermore, two different scenarios were examined depending on if the trading platform requires a commission. The top three indicators, which were the same in both scenarios, are the following:

1. Ultimate Oscillator (Momentum Oscillator) observed monthly
2. Moving Average Convergence Divergence (Trend Indicator) observed monthly
3. Simple 200-period Moving Average (Trend Indicator) observed weekly

In both scenarios, these indicators nearly double the initial investment in just four years, meaning that they generate over four times the profit of the Average Lending Interest Rate of the United States at the time. Nevertheless, experienced traders would use a variety of Technical Analysis indicators to execute a single trade when they all signal the same action, resulting in significantly higher returns while reducing the number of trades and commissions.

Both the Financial and Technical Analyzes conclude that an investment in the Nasdaq-100 using the right tools can be a very lucrative one. In order to achieve the best results possible, an investor should always abide by the following:

- Performing Financial Analysis on securities in order to get an insight on their performance and management. These kinds of data are publicly available and they provide valid indications about a security's progress.
- Performing Fundamental Analysis helps investors keep track of new developments that affect the security by examining related economic and financial factors. Such factors include interest rates, inflation, deflation, GDP growth rates, employment statistics, trade balances, political events, military conflicts and quantitative easing performed by central banks.
- Performing Technical Analysis helps investors pinpoint the best time to invest in a security by using a series of indicators that suggest when they should open or close their positions. Different indicator categories should be consulted and the trade should only be executed when many of them signal the same action.
- Placing Stop-Losses. Stop-Loss orders help limit losses in case prices pull back after an investment is made. For example, setting a stop-loss at 5% below the buying price will limit the loss to 5%. However, prices might eventually skyrocket after an initial pullback so this feature should be used with caution.
- Making sure that the money committed to the investment will not be needed in the foreseeable future, not even in case of an emergency. This will prevent the investor from panicking and help him be objective and calm on his decisions.
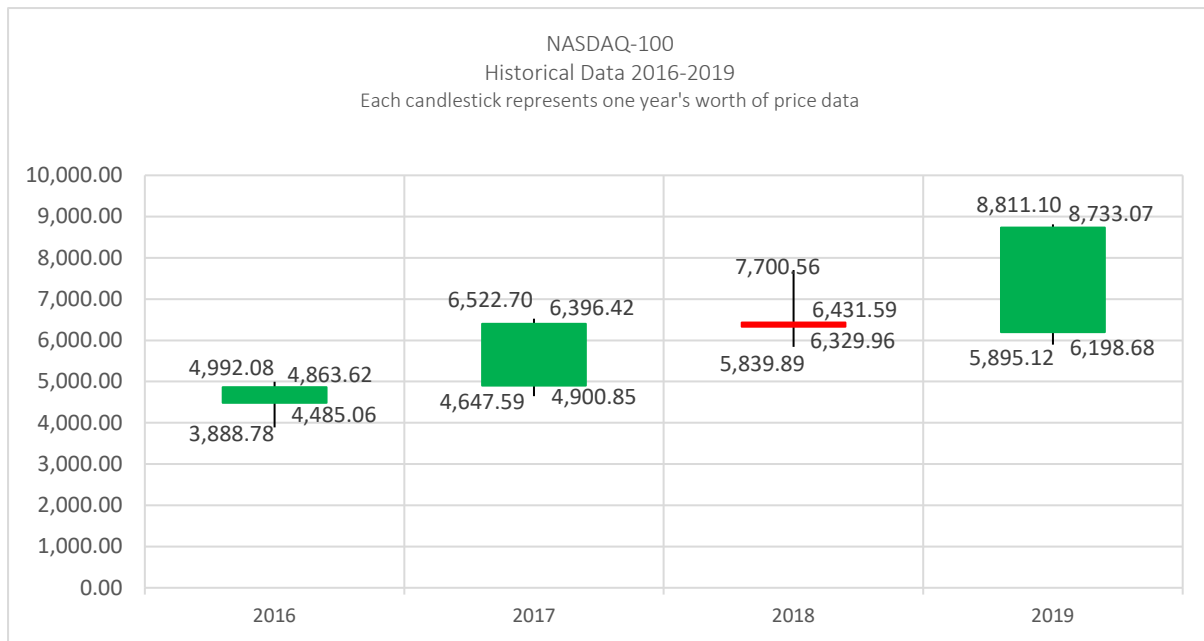
Appendices

Appendix A: Nasdaq-100 Daily Historical Candlestick Price Chart
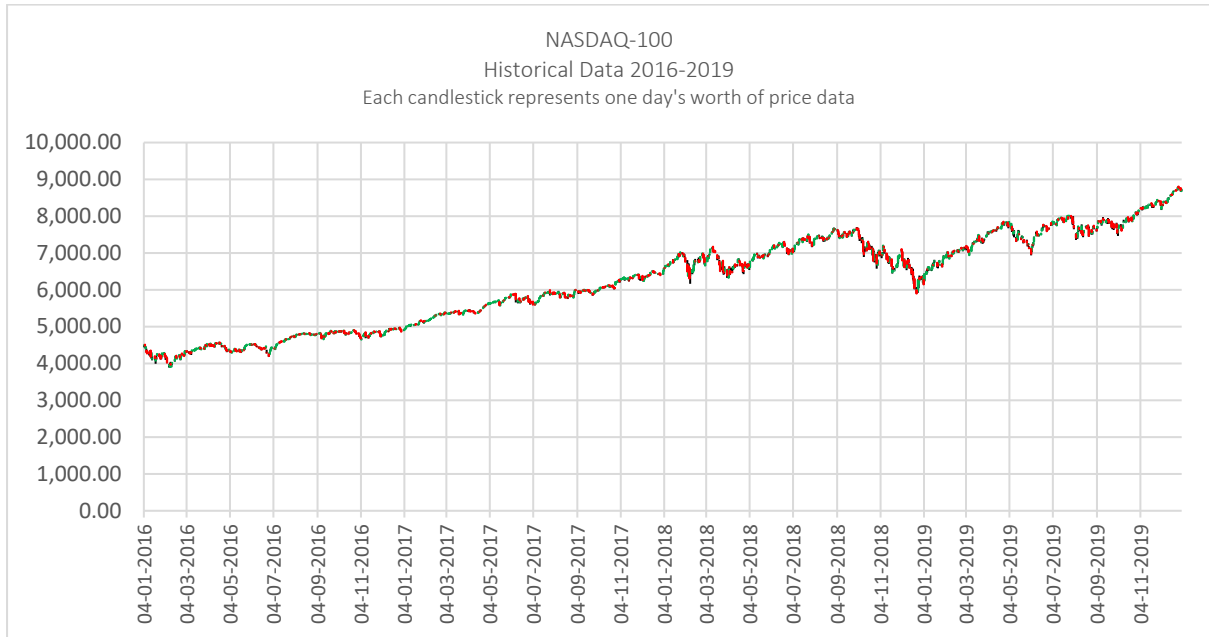
Appendix B: Nasdaq-100 Monthly Historical Candlestick Price Chart
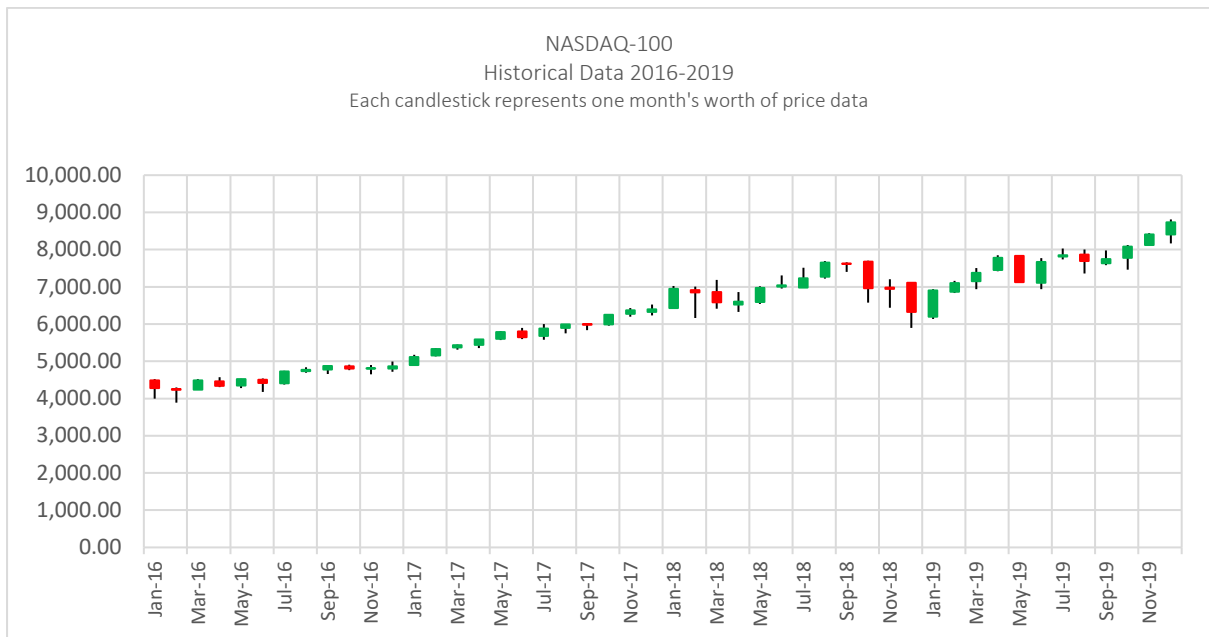
Appendix C: Nasdaq-100 Yearly Historical Candlestick Price Chart

NASDAQ-100
Historical Data 2016-2019
Each candlestick represents one year's worth of price data

Appendix D: Nasdaq-100 Best Results per Indicator 0% Commission

Technical Indicators	Category	Highest P/L		
		P/L (%)	Time Frame	Transactions
Ultimate Oscillator	Momentum Oscillator	104.08%	1M	2
MACD (12,26)	Trend Indicator	104.08%	1M	2
SMA (200)	Trend Indicator	103.87%	1W	2
EMA (200)	Trend Indicator	103.87%	1W	2
ADX (14,14)	Trend Indicator	99.50%	1M	4
CCI (20)	Momentum Oscillator	95.37%	1W	4
SMA (100)	Trend Indicator	92.85%	1W	4
EMA (100)	Trend Indicator	92.85%	1W	4
EMA (10)	Trend Indicator	91.29%	1M	6
EMA (50)	Trend Indicator	90.17%	1W	8
SMA (20)	Trend Indicator	87.04%	1M	4
EMA (20)	Trend Indicator	87.04%	1M	4
SMA (10)	Trend Indicator	86.15%	1M	6
SMA (50)	Trend Indicator	85.33%	1W	8
RSI (14)	Momentum Oscillator	70.30%	1W	12
ROC (9)	Momentum Oscillator	69.13%	1M	6
STOCH (14,3,3)	Momentum Oscillator	66.08%	1W	28
Williams %R (14)	Momentum Oscillator	49.05%	1W	60

Appendix E: Nasdaq-100 Best Results per Indicator 1.5% Commission

Technical Indicators	Category	Highest P/L		
		P/L (%)	Time Frame	Transactions
Ultimate Oscillator	Momentum Oscillator	98.01%	1M	2
MACD (12,26)	Trend Indicator	98.01%	1M	2
SMA (200)	Trend Indicator	97.80%	1W	2
EMA (200)	Trend Indicator	97.80%	1W	2

ADX (14,14)	Trend Indicator	87.79%	1M	4
CCI (20)	Momentum Oscillator	83.91%	1W	4
SMA (100)	Trend Indicator	81.53%	1W	4
EMA (100)	Trend Indicator	81.53%	1W	4
SMA (20)	Trend Indicator	76.07%	1M	4
EMA (20)	Trend Indicator	76.07%	1M	4
EMA (10)	Trend Indicator	74.71%	1M	6
SMA (10)	Trend Indicator	70.01%	1M	6
EMA (50)	Trend Indicator	68.51%	1W	8
SMA (50)	Trend Indicator	64.22%	1W	8
ROC (9)	Momentum Oscillator	54.46%	1M	6
RSI (14)	Momentum Oscillator	49.90%	1M	4
STOCH (14,3,3)	Momentum Oscillator	49.90%	1M	6
Williams %R (14)	Momentum Oscillator	18.44%	1M	10

Appendix F: United States Interest Rates 2016-2019 from Worldbank.org

US Lending Interest Rates	
Average 2016-2019	4.449%
2016	3.512%
2017	4.097%
2018	4.904%
2019	5.283%

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